Electrical World

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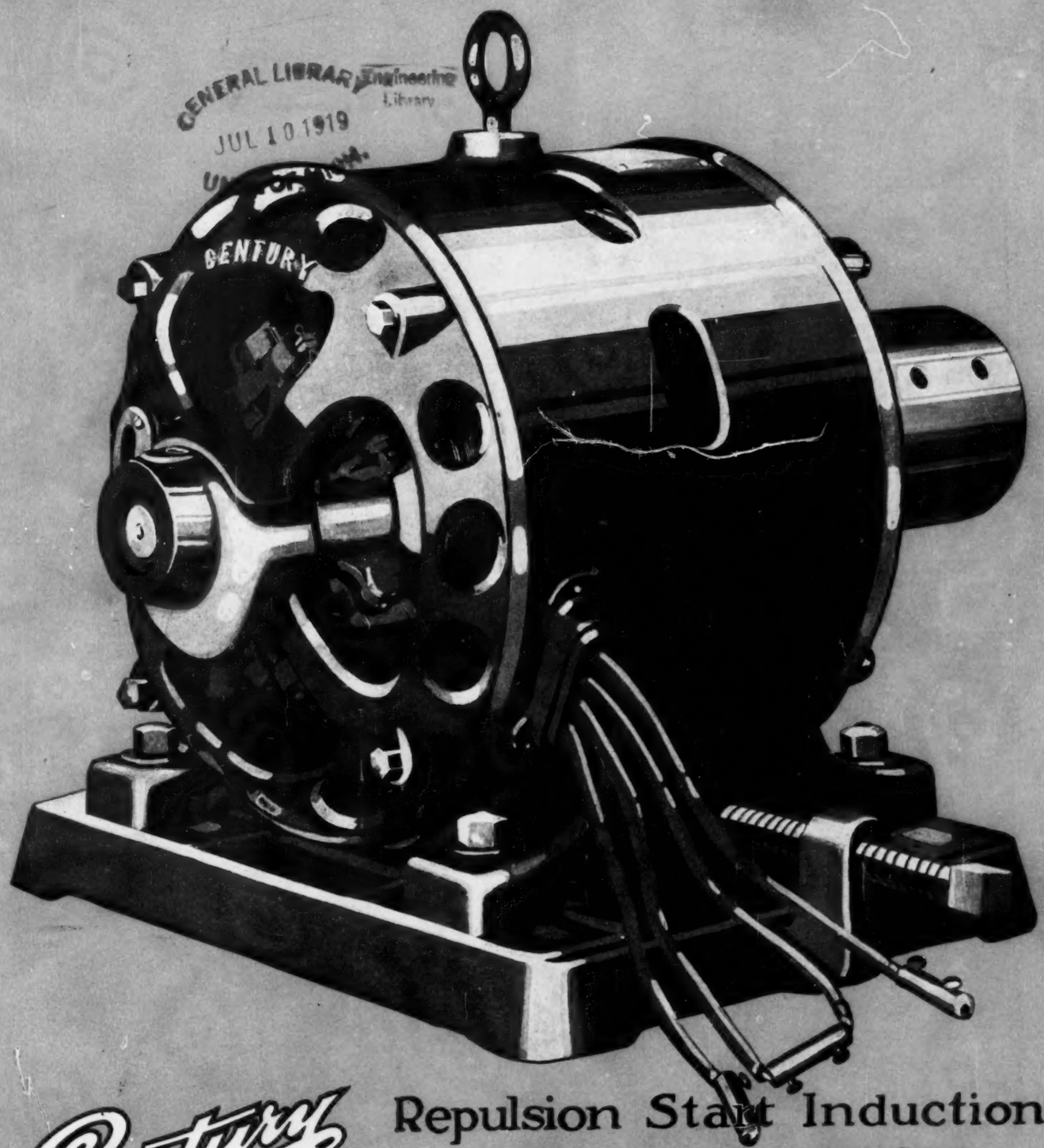

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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We Shall Use Water Powers

THERE will be genuine disappointment that Congress has not yet been able to act on the pending water-power legislation. It is sometimes difficult for the outsider to accept calmly the slow procedure which is unseparable from the final enactment of laws in the national legislature. He sees the crying need of action but he does not always understand as fully that other measures are just as vital to the country for reasons of a different character. In this case the obstacle to the prompt passage of a bill was the condition of the appropriation measures. People in Washington know how important such measures are and that the business of the nation is dependent on their regular enactment. And now that the appropriation bills have had consideration we are face to face with the international conditions which the treaty of peace and league of nations bring home to every individual citizen. Still, we know that legislation which will promote the greatest possible degree of water-power development is as sure to reach the statute books as the sun is certain to follow a schedule. In time Congress will pass a law on this subject and until it does so patience is necessary. But the priceless water powers will be put to use because the country requires the energy that they hold.

The time for general rate reductions is not yet here, nor can its coming be accurately predicted; but we have faith in the sense of justice that resides in the commissions and in their intent to see a square deal between the public and public servants.

The World Problem

THOSE who have the opportunity of making a presidential address before the annual convention of the American Institute of Electrical Engineers have presented to them a precious opening for a message of permanence and high character. In appearing before the members at Lake Placid last week, President Adams used the occasion most wisely to speak of the natural place of the engineer in the great world problem of the times. He saw the obligation laid upon engineers to use their training and experience, their "method of thought of which we are so proud" in the solution of the great questions which are the aftermath of the war. His application of the ability of the engineer would be in the encouragement of the broad, generous, coöperative spirit. This is needed more than coöperation within the Institute, more than coöperation in the entire industry, it is one of the gravest issues affecting all industries, all nations and people. The mere term coöperative is much abused, and in ordinary commercial application it has been dragged around loosely, but the sense in which it was presented by Professor Adams is significant in deep meaning. For those who understand the importance of work and research, of an orderly mental and physical progress, the dark future desired by the I. W. W.'s and the Bolsheviks of society is shown in its true sinister garb. There is no labor to which the Institute can more fittingly give its genius, its organization and its heart than that of guiding humanity carefully through the trying difficulties of the reconstruction era. The large influence of the Institute, the earnest members whom it can summons for service are an assurance that results can be obtained which will help to better the conditions of human life.

The manual workers of the civilized world show no eagerness to undertake such a tremendous experiment as Bolshevism. They desire to better their present circumstances in common with all forward-looking humankind, but as a rule they prefer to retain the existing general order of civilization and to effect improvements by majority vote instead of by force exercised by minorities.

Prices for Electric Service

WE ARE glad to note that in several instances commissions have acted on the continuance of war prices by electrical supply companies and have seen the justice and propriety of continuing increased rates under existing conditions. The immensely increased costs of material and labor put a heavy burden upon this class of public service, a burden under which the companies grimly stood pat and which they bore for a considerable time before appealing for necessary aid. We are at or nearing the summit of the inevitable results of a period of extraordinary inflation brought about by the sudden demands of war. The cessation of hostilities has not brought with it at once a reduction in costs. These under such circumstances always fall more slowly than they rose, and we are, in fact, having to meet greater demands on the part of labor, and costs of material are thereby upheld beyond their normal level. Traction companies, more sharply affected by labor costs, are still appealing for help in the form of increased fares to match the general rise in transportation expense. The light and power companies have gone very slowly and have never demanded more than was absolutely necessary in the way of increase. This increase they must have, however, to maintain their plants and keep their faith; and it is a source of satisfaction that the commissions have recognized the situation and have not hesitated in coming to the rescue. We are confident that they will continue to do so until in the course of time costs settle, probably not to their pre-war basis, but to some point that will eventually permit a reduction.

So long as coal cost stays up and labor holds scarce and dear the central station will continue to maintain an advantage more clearly demarked than under pre-war conditions over the potential isolated plant. It is interesting to note that the element of possible competition from gas utilities, however, has undergone change as a result of the recent decline in oil.

The Dollar in Maintenance

COSTS of maintenance work under existing conditions are a serious problem affecting the financial results of operation. To apply enough earnings to keep up the physical property when normal labor and material costs prevailed was a simple task compared with that which confronts the central-station manager to-day. With the purchasing value of the dollar lowered about one-half the index for measuring maintenance outlay is altered in a fashion that cannot be overlooked. If the problem had ended with the war it could now be treated more from the academic standpoint and less from the practical point of view, but the fact is that in general the war-time level of costs remains. During the war period the question of maintenance escaped the close attention which its importance always warrants, but that was because the great issue of the conflict overshadowed in all minds the less vital material things. Nevertheless, the companies that neglected their maintenance have built up a liability which sooner or later will have to be met to the full. This is the law of maintenance and it operates inflexibly whether the motive behind the policy of neglected upkeep was patriotism or inadequacy of revenue. Companies which had their rates increased made good by this means a part of their outlay for higher costs, but maintenance is only one element of operating expense and advances in other departments were also heavy.

Representatives of some companies which have been indicating an intention to reduce rates are still figuring their maintenance and depreciation on the basis used in the pre-war era. The fallacy of this practice is shown by the experience of one company which felt in 1914 that from 15 to 17 per cent of the gross revenue was a generous allowance for what it classified as "depreciation and maintenance." To-day the same amount of labor that was provided for in the 1914 outlay would make the total expenditure in this company 30 per cent of its gross revenue, or roughly double the proportion applied five years ago. Wages are higher and efficiency is lower. Experience of different companies will vary from this, but no one can question the real need for analytical study of present maintenance costs. Such a study will be invaluable, not only as a guide in rate-making, but also to show how effectively maintenance work is carried on to-day for a given expenditure. It will furthermore be authoritative information for regulating commissions and consumers as well as for managers of properties themselves. It is unsafe from the standpoint of financial integrity to risk any change in the basis of maintenance provision that might cause premature deterioration of the physical property.

Another point which bears upon this question from another angle is that of the possible inadequacy of maintenance of apparatus during the period from 1914 to 1919. This was an era of tremendous growth for the central station and one of increasing responsibility and strain as we drew toward the conflict and then threw the industrial weight of the country into the hard struggle. The demand for power meant that the central station was called upon to do its uttermost in generation of energy. Load and overload conditions were of such a trying character that it will be remarkable if apparatus shows no premature depreciation in physical condition as a result of the burden put upon it. If it shall develop within the next few years that the war strain operated to shorten the useful life of apparatus there will be a demand upon current maintenance or depreciation reserve which will be imposing in amount. We have called attention before to the possibility that extra maintenance expense may develop sooner or later because of the war strain. The obligation to protect property gains a singular emphasis when we review the conditions of changed purchasing power of the dollar and of possible unseen depreciation liability arising from the hard usage of equipment during the war. It is a time to measure the present profit in existing rates with an eagle eye and a cool head.

Over-motoring was patriotic in the dark days of Ypres and Verdun, but it is no longer economically permissible to retain a wasteful surplus of driving power in the modern industrial plant. Power surveys are as necessary to-day as the indication of steam engines and in the re-allocation of motors to their drives lies a wonderful opportunity for the efficient plant administrator.

Effect of Transient Voltages on Dielectrics

UNTIL comparatively recently it used to be supposed that an air gap of fixed dimensions was as easily disrupted at one frequency as at another. It is now known, however, that needle-point spark gaps are more easily disrupted at low frequencies than at sudden impulses provided that sufficient time is allowed for the low-frequency voltage to ionize the air around the needle points and form corona caps over them. On the other hand, sphere gaps do not appreciably favor sustained low frequencies. This gives the sphere gap a great inherent advantage over the needle gap in the measurement of high voltages by length of gap.

In a highly practical paper read by F. W. Peek, Jr., at the annual convention of the A. I. E. E. some very interesting facts are brought out concerning the properties of various spark gaps. For example, it appears that a horizontal sphere gap sparks over with about half the voltage in rain that is necessary when it is dry, under sustained 60-cycle voltages. On the other hand, the rain has no appreciable affect on the same gap with very steep-front impulse voltages. Consequently it is desirable to have arrester spark gaps covered by rain shields, if they are installed in the open air, on industrial circuits.

Another interesting property described in the paper concerns the behavior of sphere gaps closely connected in simple series from a line to ground. If the two gaps are of the same length but the two capacitances of the gaps are unequal, the total breakdown voltage will be less than the sum of the two individual breakdown voltages. If, however, the two gap capacitances are

adjusted to equality, this discrepancy disappears. This is explained by the fact that when the capacitances are unequal the voltages impressed upon the two in series are unequally divided. The one having the greater share breaks down first and then throws the full voltage on the other, except for its arc resistance.

The steepness of the voltage wave fronts in high-frequency impulses comes out astonishingly great. It is shown that the gradients are of the order 10^{12} volts to 10^{13} volts per second. The electric activity in a gap subjected to such a sudden rise of voltage is considerable.

According to railroad returns under government control and operation, when business decreases expeses go up and when business increases profits lessen. The end of this tangled thread lies in the taxpayer's pocket, and the unraveling process, if not painful, is bound to be costly. Thanks be that electric utilities in the main were not drawn into the web of government administration as the war progressed toward its end, and let those of us who remained in the field of private operation under public regulation rejoice in our present opportunity to clinch popular opinion by "A1" service at fair rates in favor of individual initiative and progress.

Rapid Testing of Magnetic Materials

THE magnetic properties of iron and steel are of great practical importance to the electrical engineer. A comparatively small difference between two brands of steel, in regard to permeability, may require a considerable difference in magnetomotive force, with machines employing these two qualities of material. Similarly, a comparatively small difference between the coercive forces of two brands of laminated steel may involve a considerable difference in the hysteretic loss of power, with armatures employing these two qualities of laminae. Tests on samples of magnetic materials have thus to be maintained perennially in all large electrical engineering works laboratories.

If the samples of steel have to be tested with great care, ballistic-galvanometer methods applied to ring samples are probably the best. On the other hand, if mere comparisons of magnetic quality are sufficient, a variety of permeameters and hysteresis indicators suggest themselves for rapid and convenient application. Rings take time to prepare, they require careful machining. They take time to wind with wire. The ballistic galvonometer takes time to give a deflection, and the computation, after the observations, is also a time-consuming process. The comparison permeameters are usually satisfactory with straight sample bars; their windings are permanent and they grind out their results with the regularity of the sausage machine. However, the speed of operation usually entails some lack of precision.

It is interesting to notice that, in this number, Thomas Spooner describes a series of recent and numerous magnetic tests, on a variety of samples, in which it was decided to use the ring ballistic method, rather than the shop permeameter methods, so as to secure reliable results. By systematising and simplifying the process, the speed of testing was greatly increased. The standard rings were small and of easily machined dimensions. The windings could be swiftly applied. The electrical instruments used could be calibrated for evaluating the required data directly, from their scales. Incidentally, magnetic intensities up to 300 gilberts per cm. are referred to, which are of very respectable magnitude. Permeabilities of 30,000 to 40,000 are also mentioned, which are also of the brahminical type. If such results were obtained from swift and approximate permeameter observations, they would be more open to doubt and incredulity. It is, therefore, the more advantageous to have them obtained ballistically.

The weak points of the small ring method against which the experimenter has to guard are: machining error in cross section, errors in average permeability due to differences in magnetic intensities at the inner and outer surfaces of the ring, and the possibility of affecting materially the average magnetic quality of the sample by the surface hardening of the ring substance in machining. The first and third troubles can be minimized by the skill of the mechanic. The second can be minimized by keeping the radial thickness small and by care in making the tests.

The details of Mr. Spooner's description lend it unusual interest.

Better distribution system records will pay a rich return upon their cost to many a central station. Accurate, detailed data always kept up to date and at the instant disposal of construction and trouble men mean the quicker restoration of service and a more satisfied public. Card records, maps and loose-leaf methods have rendered delays in locating circuits and accessories under emergency conditions inexcusable; but how often only fragmentary information can be instantly supplied over the wire to the man in the field! There never was a better chance to set the house in order than in this transition period from war to a peace basis of central-station development.

Relative Characteristics of Magnetic Chucks

THE magnetic chuck as an inventive conception is an old affair. As an effective tool that will never slip in the work, and never fail to let go when the work is done, the magnetic chuck is of relatively recent date, and is by no means widely recognized.

A good magnetic chuck must not fail to excite or release. It must not get too hot in continuous service. It must not have so much magnetic leakage that all steel in its neighborhood shall be magnetized, including the watch in the workman's pocket. It must not draw steel filings into bearings and working parts.

The attractive pull on the face of the chuck is easily carried to 7 kg. per sq.cm. of active surface, and the frictional force resisting sliding should not be less than 1 kg. per sq.cm. In some cases, this does not give sufficient margin of security against the sliding of the work and finger pieces or stops have to be used.

The characteristics of different types of magnetic chucks are compared and illustrated in this number, by O. A. Kenyon. It is interesting to see how many different requirements have to be taken into consideration in the design of such an appliance. Fortunately, the design is nearly always confined to direct-current supply. An alternating-current magnetic chuck would be much more difficult to produce.

Rapid Testing of Magnetic Materials

Speed and Accuracy Are Obtained by the Use of Small Ring Samples and the Ballistic Method of Testing—The Employment of Coils of Few Turns with High Magnetizing Current Makes the Ring Method Practicable

BY THOMAS SPOONER
Research Department Westinghouse Electric & Manufacturing Company

IN CONNECTION with certain recent magnetic investigations it was necessary to determine the magnetization curves and hysteresis loops for a large number of samples of cast and forged material. A method of testing, employing ring samples and ballistic galvanometer, by means of which a magnetization curve could be obtained in four and a half minutes and a complete hysteresis loop in six minutes, was adopted. The method is both accurate and reliable.

In the early stages of this work the samples were forged into rods 10 in. (25.4 cm.) or 12 in. (30 cm.) long, machined to ½-in. (1.27-cm.) diameter and tested by means of a Burrows permeameter. This method of testing was unsatisfactory for several reasons: (1) It was rather slow and tedious, as it was often possible to test only two or three samples a day. (2) Some of the material had a maximum permeability of 30,000 or 40,000, and the Burrows apparatus is not very accurate under these conditions. (3) A rather experienced man was required to obtain reasonably rapid and accurate results; this was especially true for pure iron samples where the resistance was low and the time constant large. (4) There was danger of the testing yokes introducing strains into the samples which might appreciably alter the results.

When it was realized that the Burrows permeameter would not be adequate for the work in hand, a number of other methods were considered, some of them more or less automatic, involving photographic records, etc. It was finally decided, however, that the simpler the apparatus the better, and in accordance with this decision the following arrangements were evolved.

Preparation of Sample

No form of sample is so easy to test as the ring, and no other form of sample can be tested with such a high degree of accuracy. The objection to the ring is the time and labor involved in winding the test coils. This can be reduced in two ways: (1) By using split windings which are connected by mercury cups or other suitable joints; (2) by providing a very sensitive apparatus, thus permitting the use of a very few secondary turns, and by using large magnetizing currents, thus requiring very few primary turns. The latter method was adopted.

The standard ring as finally used had an outside diameter of $\frac{31}{32}$ in. (2.46 cm.), an inside diameter of $\frac{23}{32}$ in. (1.83 cm.) and a thickness of $\frac{3}{8}$ in. (0.95 cm.). This gives a cross section of 0.302 sq.cm. An accuracy of 1 per cent in cross-section could easily be obtained by the machinist. The ingot of magnetic material as delivered from the furnace was forged into a rod of slightly more than 1 in. (2.5 cm.) diameter and as many rings as needed could be machined from this forging, as it was often desired to have a number of samples, to be subjected to various treatments. Sometimes one end of the ingot was forged into a long narrow rod for conductivity tests or for use in the Burrows apparatus. The rings were insulated with "Empire" cloth tape and wound with twenty turns of No. 30 DCC copper wire for the secondary. The primary winding consisted of sixteen turns of copper cable with single-braided cotton insulation and a conductivity equivalent to No. 14 copper wire. A boy could easily wind a ring in ten minutes.

Selecting and Arranging Testing Apparatus

A plain ballistic test was used, but with certain refinements to increase the speed of operation. In the first place a very sensitive galvanometer was necessary. This need was adequately met by means of a Leeds & Northrup high-sensibility ballistic galvanometer having a sensibility of 0.00035 microcoulomb per millimeter. In order to save floor space an optical system was arranged as shown in Fig. 1. The total distance from the galvanometer to the scale was approximately 11 ft. (3.5 m.); and with a standard ring sample a ballistic deflection of a little over 20 cm. could be obtained at an induction of 10,000 gausses. Fig. 2 shows a photograph of the apparatus and Fig. 3 a diagram of connections. Since only a few primary turns were used, as stated above, it was necessary to employ large primary currents when testing at high inductions. A maximum current of 100 amp. from a 30-volt battery was regularly used. This could be pushed still higher if necessary. One hundred amperes corresponds to a field intensity of 300 gilberts per centimeter, which is sufficiently high for most purposes. The samples, of course, had to be placed in an oil bath, and even then rapid testing was required above 200 *H* in order to prevent undue heating of the samples and windings. Since it was possible for a machinist to duplicate the cross-section of his samples to 1 per cent, it was found desirable to test 10 samples together by putting all the primary windings in series and connect-

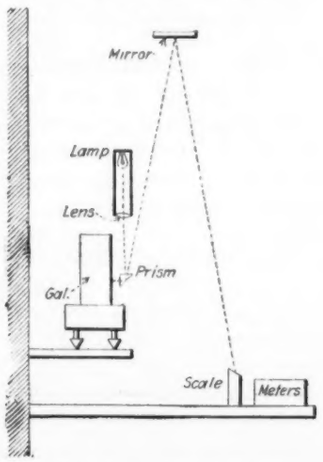


FIG. 1—SAVING SPACE IN OPTICAL SYSTEM

ing the secondaries in succession to the galvanometer for each value of H. The primary switching was done by means of 200-amp. rocker knife switches operated by foot power. The values of H were read by means of shunts and millivolt-meters with special scales. Since $H = 3I$ approximately, a meter with thirty divisions and giving full scale for 1, 10 and 100 amp., for instance, would indicate H directly.

In order to reduce the range of resistance necessary in the primary circuit, it will be noted (see Fig. 3) that a tap was brought out from the battery and by means of switch 4 either 4 volts or 30 volts could be applied to the sample. Millivolt-meter B was always in circuit, but millivolt-meter A, which is much more sensitive than B, was cut with the 30-volt connection. By the use of these two millivolt-meters and shunts it was possible to cover all ranges of magnetizing forces from $0.1H$ to $300H$, millivolt-meter A being a two scale instrument and B a three-scale.

OPERATING THE TESTING EQUIPMENT

Testing.—The first step after connecting the ten samples was to adjust the galvanometer sensibility. For magnetization curves switches 2 and 3 were closed up and 4 down. Switch 5 was closed and switch 6 closed on one of the secondary windings. The current was adjusted to 1 amp. (as read on millivolt-meter A) by means of resistances R_3, R_4 and R_5, this being the current in the primary of the mutual inductance, and switch 1 was reversed by means of the foot lever. The series and parallel resistances R_1 and R_2 were then adjusted until the galvanometer gave a deflection of 10 cm. on reversing

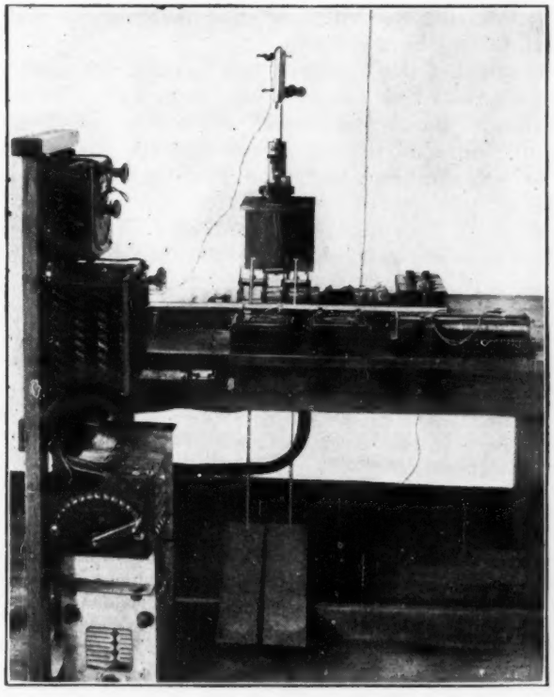


FIG. 2—ARRANGEMENT OF TESTING APPARATUS

switch 1. The mutual inductance was of such a value that this corresponded to 10 kilogausses in one of the rings. The current was then reduced below the lowest value desired for the first value of H and switch 3 closed down. The reading of the millivolt-meter A was then adjusted to some value of H, say 1, and switch 1 reversed. The reading of the galvanometer gave B directly. Switch 1 was again reversed, which gave B for sample 2. This was repeated until all the samples had been tested at $H = 1$. H was then increased to the next value desired and the process repeated. At high values of H, R_6 was used. For low values and for hysteresis loops

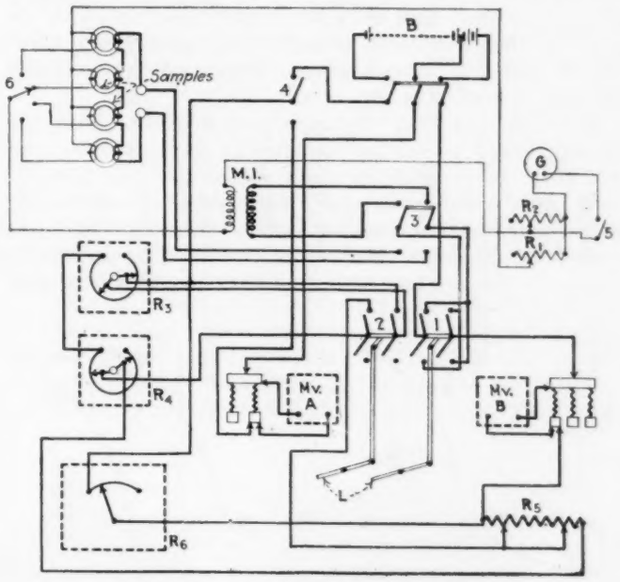


FIG. 3—DIAGRAM OF ELECTRICAL CIRCUITS

it was open. It may be noted that while the value of B was being written down, switches 1 and 6 were being operated by the foot and the left hand respectively. At very high inductions it was necessary to work rapidly and pause a little between readings to prevent the samples from heating unduly.

In order to obtain hysteresis loops only one sample was tested at a time unless two happened to have identical tip values, which was rare. However, the primaries were still left in series. The galvanometer resistances were now changed to give double the deflection with one ampere reversed in the mutual induction primary. This would give a reading of 1 cm. deflection for a change of 1 kilogauss in induction. After demagnetizing, the value of H was found for the tip of the loop (usually tests were made at $B = 10{,}000$ gausses only). After the sample had been put through the loop a sufficient number of times, switch 2 was opened by the foot lever and the current adjusted to give the desired value of H, say point b (Fig. 4). It will be noted that the resistances R_3, R_4 and R_5 have two sliding contacts which are shorted when switch 2 is up and separated when switch 2 is down. By this means the current could be reduced to any desired value without the use of additional resistances over that required for the magnetization curves. The sample was then put through the loop by closing switch 2 and reversing switch 1. Switch 2 was then opened and the corresponding deflection subtracted from the tip value of the induction gave the first point on the loop, namely b (Fig. 4). H, of course, was given by the millivolt-meter. Switch 1 was then reversed, switch 2 closed and switch 1 again reversed. This returned us to the tip of the loop at a. The foot was now placed on both treadles and switches 1 and 2 operated simultaneously. The tip value of the induction subtracted from the corresponding deflection gave point c with a negative H equal to the positive H of point b. In

this way as many points on the loop as desired could be obtained.

For the standard rings it took about four and one-half minutes per ring to obtain a fourteen point magnetization curve and six minutes to get a ten-point hysteresis loop. This included connecting up the samples, calibrating the galvanometer, recording the data, etc. If a photographic method had been used, the time necessary to develop the films and transfer the data from them would probably have been as great and the probable accuracy would have been less.

It is obvious that the apparatus could be used for testing rings or similar samples of various sizes and for rings punched from sheet material. The test results were very satisfactory even with low-resistance, large cross-section samples where the eddy currents caused considerable time lag in the building up of the fluxes. The galvanometer was very much overdamped

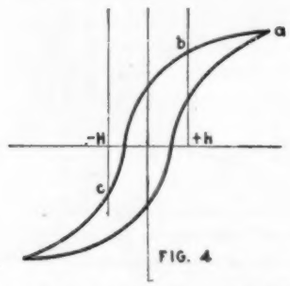


FIG. 4

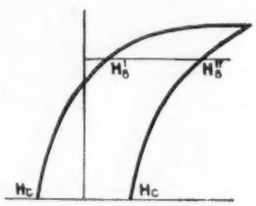


FIG. 5

FIGS. 4 AND 5—DETERMINATION OF HYSTERESIS LOOP

and, the scale distance being long, the deflections were small, so that the actual torque of the suspension was small, thus giving the effect of a flux meter. Samples have been tested satisfactorily which required fifteen seconds for the flux to reach its full value after reversing the primary current. This was effected by allowing the galvanometer to finish its swing near its natural zero point.

This apparatus is so sensitive that very small rings can be tested by means of it. In one case satisfactory magnetization curves and hysteresis loops were obtained on a number of rings ¼ in. (6.35 mm.) outside diameter by $\frac{3}{16}$ in. (4.76 mm.) inside diameter by ¼ in. (6.35 mm.) thickness and having a cross-section of 0.051 sq.cm. Enameled wire was used in the windings.

TEST RESULTS

After obtaining the test results it was customary to plot the magnetization curves and hysteresis loops on 4-in. by 6-in. (10-cm. by 15-cm.) cards having cm. and millimeter coördinates the file them away for reference. For accurate work the areas of the loops were measured with a planimeter and the hysteresis losses calculated. The plotting and measuring required, however, about the same length of time as the testing, and where it was desired to save time the results for various samples could be easily compared from the original data, since tests were usually made at standard values of H, as, for instance, 1, 2, 4, 10, 20, etc. As for the loops, a rough plot would give enough data to furnish a fairly good idea of the hysteresis loss by using the following quick method which eliminates the necessity of using a planimeter. Take, for instance, a loop having a maximum B of 10,000 gausses. Let H'_s and H''_s (Fig. 5) be the two values of H for $B = 8000$ gausses and H_c the coercive force.

Calculate the factor

$$K = \frac{2(H''_s - H'_s)}{2H_c + H''_s - H'_s}$$

The loss in ergs per cubic centimeter per cycle, if B is given in gausses and H in gilberts per centimeter, is

$$W = \left(\frac{K \times H_c \times 10^4}{\pi}\right)$$

Thirty loops of various shapes and losses were selected at random and gave the following calculated results as compared with the results obtained with the planimeter: Average difference, 1.7 per cent; maximum difference, 4.9 per cent.

This method does not give reliable results with high induction loops, but it is satisfactory for 10,000-line loops if the factor K is not less than 0.8. It is thus evident that a knowledge of three points on the 10,000-gauss hysteresis loop is sufficient to enable one to determine the hysteresis loss with sufficient accuracy for most purposes. The calculation requires less than two minutes with the use of a slide rule.

ASSOCIATION ACTION ON THE BUREAU OF STANDARDS

Attitude and Resolution of the Southwestern Electrical & Gas Association and Pacific Coast Section of the N. E. L. A.

At their recent conventions the Pacific Coast Section of the National Electric Light Association and the Southwestern Electrical & Gas Association took action in regard to the work of the Bureau of Standards.

After an explanation of the National Electrical Safety Code the Southwestern association indorsed the following statement by a delegate:

"Although I don't believe this association could put itself on record as adopting this code, yet I think the association should put itself on record as favoring bringing our distribution system and our power plants up to a higher standard, and I move that it be the sense of this meeting that it is recognized that we should work to a higher standard as a matter of self-preservation and that therefore those stations which have not adopted the standard should obtain a copy of this bulletin with a view of bringing their systems up as far as possible to that standard."

A resolution passed by the Pacific Coast Section of the N. E. L. A. follows:

Whereas, there are existent in the State of California and other commonwealths of the West, comprising the membership of the Pacific Coast Section, N. E. L. A., legally constituted bodies whose function it is to supervise the establishment of rates and the general efficiency of public service corporations serving the public; and

Whereas, conditions west of the Rocky Mountains present new and unusual features in the development of our natural resources peculiar alone to this great section of our nation; and

Whereas, the aforesaid legally constituted regulating commissions enjoy the complete confidence of the utility companies and the public served in the performance of their duties;

Therefore be it resolved, that we, the members of Pacific Coast Section, N. E. L. A., in convention assembled at Coronado, do hereby express our disapproval of the proposed establishment of a standard of ethics by the Bureau of Standards at Washington purporting to outline methods of operation, the fixing of rates or any other matters that are to-day rightfully enjoyed by the aforesaid regulating commissions in the commonwealths of the West.

Selecting Equipment for Industrial Lighting—II

Complete Analysis of Reflecting and Diffusing Units for Lighting Industrial Plants, Giving Advantages and Limitations of Each—Useful Data Concerning Distribution Curves—Efficiency and Mounting Heights Are Features

BY WARD HARRISON AND H. H. MAGDSICK
National Lamp Works of General Electric Company, Cleveland

METAL reflectors, because of their mechanical strength and freedom from breakage, have long been favored in industrial lighting. Their design has in recent years been highly developed. The permanence of a porcelain-enameled steel surface, even under unfavorable atmospheric conditions, its moderate cost, and the ease with which it can be kept clean, have made it the most generally employed among all industrial reflectors. The reflection factor of good-quality porcelain enamel ranges from 65 to 70 per cent. While this value is not high, it is maintained permanently. Since some porcelain enamel is inferior from the standpoint of reflection factor, care should be exercised in the selection of such reflectors. Any enamel which appears grayish or bluish will be of considerably lower efficiency than one that is white. On the other hand, a slight yellowish cast will show little effect, inasmuch as the yellow rays predominate in the light from incandescent lamps. Not more than one-sixth of the light returned from porcelain enamel is regularly reflected as from a mirror. The rest is reflected diffusely, as from a depolished or matte surface, and its distribution is therefore independent of the contour of a reflector of given diameter and depth. The degree of control which can be exercised over the distribution of light is thus limited, but is sufficient for most factory lighting requirements. The angle at which the direct light from the lamp is cut off by the reflector and the area of the surface are the characteristics of most importance.

FIG. 1—FLAT CONE

FIG. 2—BOWL

FIG. 3—DOME

FIG. 4—RLM DOME

Considerations of reflector and lamp breakage with possible injury to materials and workmen, as well as the cost of replacements, have led to a smaller demand for glass than for metal reflectors in industrial plants. There are, however, many manufacturing conditions under which these considerations are of minor effect and where glass units of the proper type may be applied with advantage.

METAL REFLECTORS ANALYZED

One of the earliest types of porcelain-enameled reflectors was the flat cone (Fig. 1). To-day its proper application is limited to exterior lighting. For the illumination of interiors this unit is never to be recommended, since a higher intensity of illumination of better quality can be obtained with other types. The edge of the reflector is at or above the center of the lamp filament, hence not more than one-half of the light is intercepted, and the efficiency of the unit in directing light to the work is of necessity low.

The deep, or bowl, reflector illustrated in Fig. 2 has been largely employed to give maximum shielding of the lamp filament. The mistake is frequently made of assuming that since this reflector intercepts more light than other types, it is the most efficient in directing light to the work. On the contrary, the output of typical bowl reflectors is only 65 per cent. The candlepower below the unit is at no angle materially greater than for the dome, because of the losses resulting from cross-reflection in the reflector, and at the higher angles the intensity is considerably reduced. Surfaces above the general level of the work are frequently inadequately lighted with such units, and a room with dark walls is likely to appear dingy. Furthermore, the surface from which the light is received is so small that shadows are sharp and may prove annoying.

The dome shape (Fig. 3), a mean between the flat and bowl types, became the standard for the majority of installations of vacuum lamps and steel reflectors. The output of typical reflectors is 75 to 80 per cent of the light generated by the lamp. The percentage of light utilization is high, as with any enameled unit. Experience shows that under most conditions the eye is sufficiently shielded from glare when vacuum lamps are employed, yet enough light is emitted at the higher angles to illuminate higher vertical and oblique surfaces properly. The large area of the reflector provides a source of illumination which tends to minimize the harshness of the shadows.

However, with gas-filled lamps in these reflectors the greater brightness of the filament makes added protection from glare desirable. Furthermore, the gas-filled lamp with its concentrated filament made it possible to achieve a more nearly ideal reflector design than was possible with vacuum lamps. After a thorough study of

the requirements, the principal manufacturers of metal reflectors and the illuminating engineers of the lamp manufacturers evolved specifications covering a standard design which virtually combines the advantages of the older dome and bowl types. The angle of cut-off was made somewhat lower than in the old form of dome, and this gave the required added protection from direct glare without appreciably sacrificing effectiveness of illumination. Reflectors which comply with these specifications are known as the RLM standard (reflector and lamp manufacturers' standard) dome. With this unit available the field for the bowl reflector becomes much restricted. The general lighting of a plant can be done more effectively with the RLM dome in almost every case.

FIG 5—OPAL-GLASS CAP

FIG 6 — ANGLE REFLECTOR

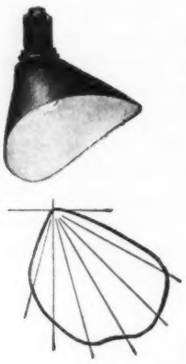


FIG 7—ANOTHER ANGLE TYPE

FIG. 8—ALUMINIZED STEEL

FIG. 9—MIRRORED GLASS

ADVANTAGES OF RLM STANDARDS

In addition to maintaining the proper angle of cut-off the specifications for the RLM standard reflector require that the enameled surface be of good quality and high reflecting power, the diameter of sufficient magnitude and the contour such as to distribute the light most effectively. To comply with these specifications it is necessary for a manufacturer to have his reflectors inspected and tested at regular intervals by an independent laboratory to insure that the requirements are met at all times. RLM standard specifications are also in preparation covering the other types of metal units, so that the purchaser may know in buying any RLM standard reflector that it is of a character which will give him the best service.

Clear-bulb gas-filled lamps should not be used in dome reflectors at mounting heights of less than 20 ft. (6 m.). At this height the nearest lamp within the usual field of vision is so far removed that ordinarily the amount of light entering the eye directly from it is insufficient to cause glare; also the lighting unit subtends so small an angle at the working surface that shadows are not greatly softened by frosting the lamp. When suspended nearer the floor the lamps should be bowl-frosted or otherwise rendered diffusing. So far as direct glare from the units themselves is concerned, bowl-frosting the lamps would usually prove sufficient. The output of the units is then approximately 70 to 75 per cent. However, in some cases the resulting brightness of images of the unit in polished surfaces at the work may be found excessive and shadows remain so sharp as to be annoying, inasmuch as nearly one-half of the light received at the work comes directly from the small surface of the lamp itself. Where the more exacting visual requirements exist it is well to fit the lamps with the dense opal diffusing cap shown in Fig. 5. When this is done, glare, both from the lamp itself and from specular images, will almost entirely be eliminated. The output of the unit will be approximately 65 per cent, but most of this light will come from the large surface of the reflector, and therefore shadows will be made soft and luminous with gradually fading edges. The work of maintenance is somewhat increased when these glass caps are employed, inasmuch as a small amount of dust will enter the narrow space sometimes left between the cap and the lamp bulb. The glass itself, however, is smooth and readily cleaned.

Where fine detail is to be observed and close application is required, softened shadows and the maximum freedom from reflected glare are necessary to conserve vision and increase output. In the direct-lighting system this is accomplished by redirecting all of the light from a surface of large area, so that the brightness of every part of the source may be low and that the light may "shine around" objects. An illustration of this type of unit is the metal cap diffuser. A polished silver cap fits closely over the tip end of the lamp and reflects the intercepted light against the porcelain-enameled surface, whence it is thoroughly diffused and directed to the work. A reflector of special contour is required to give most effective results with the silvered reflecting cap. Direct reflections of the filament in the porcelain enamel, which are of no concern when there is direct light from the lamp itself, must here be carefully avoided.

In order to secure a wide distribution of light over the upper reflector, it is necessary that the opaque cap have a specularly reflecting surface, and that the unit may be efficient this surface should be of silver. When a plant is lighted with these units the results may be made equal to the best daylight conditions secured in the most modern factories. The metal cap is held tightly against the lamp bulb by a spring holder and the edge is so designed that no space is left through which dust might enter. Furthermore, no air circulates over the silvered reflecting surface, and therefore it retains its efficiency during the life of a lamp and need be repolished only when being installed with a new lamp.

Various equipments are available combining a flat

reflector with a metal reflecting band suspended so as to shield the eye from the direct view of the filament. They accomplish a desirable protection against direct glare inasmuch as the direct light is cut off at an angle fully as low as or lower than with the bowl type of reflector. They are not, however, designed to reduce in the slightest degree the brilliancy of specular images of the lamp filament in the work surfaces, which so frequently cause the most annoying glare. The diffusion of light is not so great as one might assume from the dimensions of the fixture, for the light is actually in large measure localized to the lamp and the small reflecting band. The upper reflector contributes only a small part of the illumination. The use of the reflecting shield may be justified as an emergency measure in connection with existing installations of flat cone reflectors, as previously mentioned, but new installations of flat shallow reflectors with reflecting shields are not to be recommended.

The angle type of reflector also finds some application in industrial plants. When employed for the general illumination of a shop they should be attached to the walls or columns between bays, and they should be suspended not less than 20 ft. (6.1 m.) above the floor, otherwise glare will be excessive when the workmen face in the direction of the units. The illumination of vertical surfaces is, of course, relatively high with such equipment. Most angle units emit a high intensity near the horizontal and therefore waste a considerable portion of the light, besides accentuating glare. For billboard or sign-lighting service, in which many of these reflectors are applied, the distribution of light is favorable. In industrial plants, however, the design shown in Fig. 7, shading the lamp more perfectly and directing the light downward and with greater spread, often has marked advantages. In general, to secure satisfactory distribution of light, angle reflectors must be combined with overhead units; the exception would be an interior which is very narrow in relation to its height.

While porcelain enamel has become the standard surface for metal reflectors, paint enamel and aluminized units are used to a limited extent. The best paint enamel has the advantage of a slightly higher initial efficiency and lower cost, but even these show marked deterioration after being in service two or three years. Hence the use of such reflectors will be found economical in installations of a temporary character. An aluminized surface gives a greater degree of control of light distribution, inasmuch as the surface is of a semi-matte character. The percentage of light reflected is rather less than with porcelain enamel and the surface does not possess the same permanency, particularly under unfavorable atmospheric conditions. At the present time, the proper application of this reflector is confined to locations where a concentrating distribution is required from a metal reflecting surface.

FLEXIBILITY OF DISTRIBUTION WITH GLASS REFLECTORS

Mirrored glass has a higher reflection factor than any other surface used in industrial reflectors. In a high-quality reflector this efficiency is maintained permanently and the direction of the light can be controlled accurately since the reflection is almost entirely regular and not diffuse. Such regular reflection of the light if unmodified would, however, lead to striations or images of the filament on illuminated surfaces. To avoid these the reflector is usually corrugated. Images of the lamp filament as seen in the reflector are nearly as bright as the filament itself; hence a reflector of a contour similar to a porcelain-enameled dome wuold be exceedingly troublesome from this standpoint. It is good practice, therefore, to use only the deeper designs in a mirrored-glass reflector. This necessarily limits the intensity at higher angles. It tends also to leave shadows dark and sharp. From the standpoint of glare from polished working surfaces a mirrored-glass unit, even when equipped with a bowl-frosted lamp, evidently is at a disadvantage inasmuch as the reflector surfaces within certain angles are only slightly less bright than the lamp filament itself. The output of typical units varies from 60 to 85 per cent, depending upon the degree of light control exercised.

Prismatic glass reflectors may be designed to redirect the light with a small absorption, and the properties of the prisms will suffer no deterioration with age. In practice, typical units are made to transmit about 15 to 20 per cent above the horizontal and to direct downward 65 to 75 per cent of the light from the lamp. As

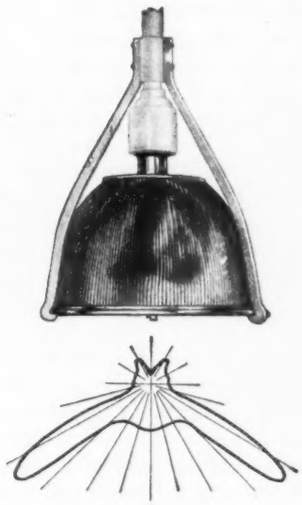


FIG. 10 — PRISMATIC GLASS

FIG. 11 — OPAL GLASS

FIG. 12 —SEMI-INCLOSING UNIT

FIG 13—GLASS-INCLOSING UNIT

in the case of mirrored-glass reflectors, prismatic units may be designed to give any desired control of light distribution. Since such reflectors are made of crystal glass and the effect of the prisms is to reinforce the structure, the mechanical strength of the units is high. A valuable feature of these reflectors is the fact that the small amount of light transmitted through the reflector brightens the ceilings and walls, gives the room a cheerful appearance and slightly illuminates shadows. Where a strongly concentrated distribution of light is required, it can be secured accurately and efficiently with prismatic units; moreover, it is possible to control the wider distributions so as to illuminate vertical surfaces to a relatively higher intensity than with enameled steel or opal glass reflectors. Because of the deep valleys between ridges of the prisms more labor is required in maintaining these reflectors than those with smooth surfaces. Loose dust on the outside of the reflector merely reduces the light transmitted to the ceiling, but grime and dirt in optical contact with the prisms nullify their reflecting properties and seriously impair the efficiency of the unit. With prismatic reflectors, shadows are sharp, as with mirrored units, and on account of the bright specular images of the reflector they are not well adapted for use above polished surfaces.

Opal Glass for Cheerful Effect

Since an opal glass surface reflects light diffusely in about the same manner as does porcelain enamel, it is not suited for use where a concentrated or otherwise accurately controlled distribution is desired. In addition to that reflected, part of the light from the lamp which would be absorbed in a steel reflector is transmitted through the glass. The total output from opal-glass reflectors varies from 75 to 85 per cent, of which from 10 to 35 per cent is in the upper hemisphere, depending upon the density of the glass. Opal units are available in various contours or types. The bowl type has usually been employed with considerable satisfaction. The light transmitted through the reflector assists in the illumination of vertical and oblique surfaces sufficiently to produce results appreciably better than those obtained with the bowl type of enameled-steel units. In fact, the illumination results are more nearly comparable with those from the dome type. Since the reflectors are of relatively small diameter, shadows are sharp when ceilings and walls are dark. However, when these surfaces are of light finish, much of the transmitted light is reflected back to the work and illuminates the shadows, besides adding to the efficiency of light utilization and rendering the appearance of the plant more attractive and stimulating.

Recently a combination glass and steel reflector has been designed which retains the principal advantage of the porcelain enamel unit together with a small component of upward light to illuminate the walls and ceiling.

Glass reflectors are particularly effective where favorable wall and ceiling conditions exist, and under these conditions the efficiency of an installation of light-density opal reflectors is only slightly less than for the bowl-type steel and about 20 per cent less than that of an installation of steel domes under the same conditions. With dense opal-glass units the percentage of light utilization is of the same order as with the steel-dome reflectors. The protection from the glare is also better than with the light density glass. The dense opal reflector is therefore to be preferred in practically all cases. Opal or milk glass is never so strong mechanically as clear glass, but no glass reflectors are suited for use when hung low on drop cords. On the other hand, in plants where they have been installed for overhead lighting in locations where they are reasonably free from being shattered by mechanical blows, the breakage has not assumed objectionable proportions. Bowl-frosted gas-filled lamps should always be employed with glass reflectors which are suspended less than 20 ft. (6 m.) above the floor, but the opal cap is not to be recommended with the bowl-shaped reflector inasmuch as excessive losses would result. Dome-glass reflectors and opal caps form a desirable combination.

Careful Use of Diffusing Globes

Diffusing globes with or without external reflectors give a pleasing appearance of brightness to the walls and ceiling of a room and also provide an excellent illumination of work in vertical or oblique planes. They should not, however, be employed except at considerable mounting heights, for with the wattages ordinarily employed for a given size of globe the brightness is above the value which can be viewed with comfort and without interference with vision. The common error with this unit is the use of lamps of too high wattage at a too wide spacing. This increases the tendency toward glare as noted above and also results in non-uniform illumination on the work.

The advantages of a source of low brightness and large area have been secured in a class of units sometimes referred to as semi-inclosing. They consist of a diffusing glass bowl suspended beneath the lamp, above which is placed either an opaque reflector or one of dense opal glass. This upper reflecting surface is made large in order to produce added diffusion. The space between the lower bowl and upper reflector is sometimes left open or it may be inclosed with clear glass. Again, the unit may be in one piece with a coating of enamel placed on the outside of the upper reflector and of the lower bowl as in Fig. 13. The most satisfactory fixtures of this type should have a bowl of considerable density so that the brightness may not be excessive. The total light output of the unit varies from 65 to 80 per cent, with 10 to 30 per cent in the upper hemisphere.

Semi-Indirect Lighting Systems

With semi-indirect systems the ceiling is used as the upper reflector and illumination received from a larger surface than with any of the equipments previously discussed. If a dense opal bowl is employed, the brightness of the glass is of the same order as that of a light-finished ceiling above it and the maximum softness of shadows is secured. For some operations, in fact, the diffusion may prove excessive. Better vision would result with a directed light from a source of low brilliancy, such as a good semi-inclosing unit or the metal cap diffuser. Light-density opal glass should be used for semi-indirect lighting with bowls of large dimensions only, so as to secure low brightness with consequent freedom from glare. However, this leads to higher cost than when a unit of dense opal glass and of smaller dimensions is employed. Semi-indirect lighting is not considered practicable in factories except where ceilings may be finished light and can be kept fairly clean, where

there are few obstructions near the ceiling, and where there is little dust or dirt to settle in the bowls. The effect of the last factor may be reduced by providing conical covers of clear glass.

TOTALLY INDIRECT ILLUMINATION

With totally indirect lighting the maximum diffusion of light is obtained, but here again, as in the case of semi-indirect lighting with dense bowls, the shadows may be so suppressed, as, in some cases, to make far less satisfactory vision of objects in their three dimensions than can be secured with direct lighting units. Since the net efficiency of light utilization is at best well below that obtained with well-designed direct lighting, it is particularly important that the surface of the reflector be of the highest efficiency. Mirrored-glass units should be employed. Porcelain-enameled reflectors are less economical under these conditions.

Relative Characteristics of Magnetic Chucks

Three General Types Are Employed, Neutral-Pole, Single-Pole and Multiple-Pole—Made for Flat-Bed or Rotary Use—Practical Requirements

BY OTIS ALLEN KENYON

ALTHOUGH the first patent for the use of an electromagnet to hold work that was to be ground or operated upon by a tool was granted nearly fifty years ago, the magnetic work-holding chuck has been extremely limited in its application until comparatively recently, and even now this form of tool is not known nearly so widely as it should be. Therefore a brief outline of the basic principles embodied in the construction of these devices will be given. At present there are many different styles of magnetic chucks on the market, but they vary mostly in the design of the pole pieces on the face of the chuck. Some have straight parallel poles and others have poles that are fantastically curved. However, all of them may be placed under one of the three following heads—neutral-pole, single-pole and multiple-pole chucks.

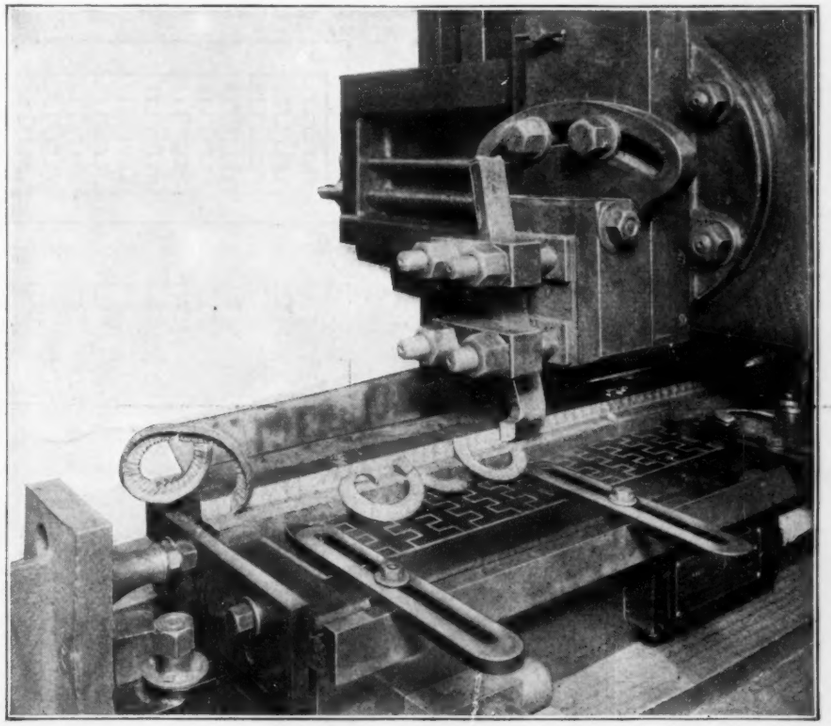


FIG. 1—HEAVY CUT BEING TAKEN BY A 30-IN. PLANER WITH WORK HELD BY UNIT-POLE MAGNETIC CHUCK

The single-pole is the oldest form of magnetic chuck. This was followed by the neutral-pole chuck, so-called because of the neutral pole between adjacent poles. The third type, which has been denoted as a multiple-pole chuck, is generally known as a unit-pole chuck, because the face plate instead of being cast in a grid shape can be built up of unit poles to any desired size simply by adding units. In describing these fundamental types the simplest designs of face plates have been employed, and the discussion starts with the neutral-pole chuck because it develops more logically that way even though the single-pole chuck was the first one to be developed.

The general design of the magnetic circuit in a typical neutral-pole chuck is shown in Fig. 3. It is made up of a series of pole pairs formed integral with the body of the chuck on one end, each pole being equipped with a coil so wound and connected as to give alternate north and south poles. The face plate of this chuck is made up of a grid casting, the openings in the grid providing proper space for pole pieces. By filling the space between them and the grid proper with a suitable non-magnetic metal the pole pieces are held in position. The purpose of using a grid with bars between the adjacent poles is to secure an even and uniform spacing of pole faces. The effect of this method of construction is to reduce air leakage when there is no work on the chuck, but, on the other hand, it increases leakage when there is work in the chuck.

Just how the neutral space between adjacent poles affects the leakage is illustrated in Fig. 5. Without the neutral pole (Fig. 5a) and with no work on the chuck, the magnetic flux passes across the gap and spreads to such an extent that it will probably magnetize any steel in its vicinity. With the neutral pole in place (Fig. 5b) this leakage is cut down enormously owing to the shortening and dividing of the air gap.

In Fig. 5c a piece of work, *B*, is laid symmetrically on

the poles, entirely bridging the neutral pole. The effect is to increase the total flux of the magnet, but the neutral pole shunts some of the flux away from the work and thus decreases the pull. If the work is so placed that it bridges one gap but not the other (Fig. 5d), the flux will decrease and the neutral pole will not only act as a magnet shunt but the unbridged gap will force more flux to leak away from the ends of the work without producing pull. On the other hand, the neutral pole is advantageous where there are small pieces of work because it provides a path for the magnetism from the pole through the work without going to the adjacent pole.

Theoretically the neutral-pole chuck is made up of independent poles. However, since all these poles are joined at the lower end magnetically and this end is carried up in the form of an inclosing wall which forms the body of the chuck, there really is a series of north and south poles along both sides of the chuck. This is most plainly demonstrated in the cross-section, *AA*, Fig. 3.

If the magnetic chuck is used in such a way that the machine on which it is mounted forms a magnetic shunt conducting flux from the bottom of the chuck through the machine to the top of the chuck, then the effective pull will be reduced and the machine and the cutting tool magnetized. This shunting effect, as well as the polarity of the shunt, varies with the position of the work on the chuck and also with that of the tool on the work. The constant reversal of the shunted magnetism

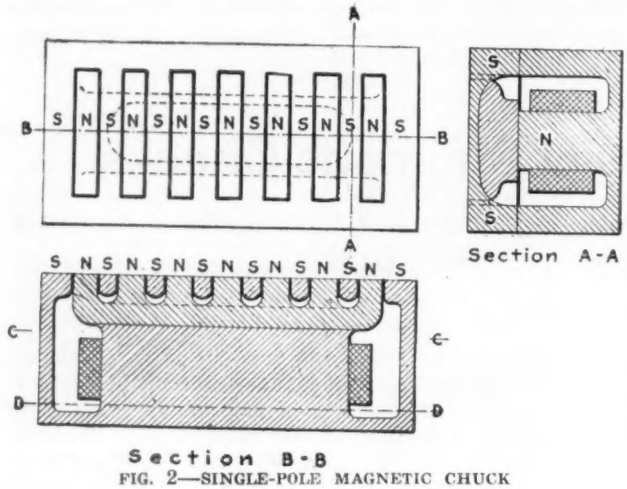
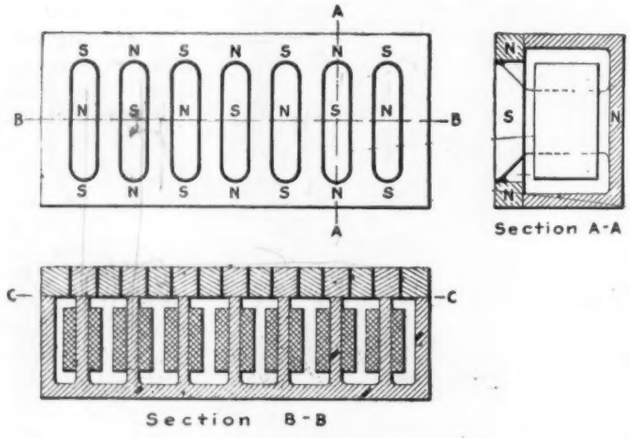
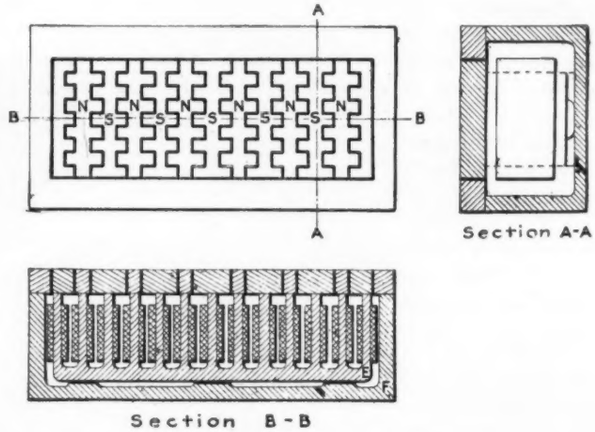


FIG. 2—SINGLE-POLE MAGNETIC CHUCK





FIGS. 3 AND 4—NEUTRAL AND MULTIPLE POLE MAGNETIC CHUCKS, SHOWING ESSENTIAL DIFFERENCES

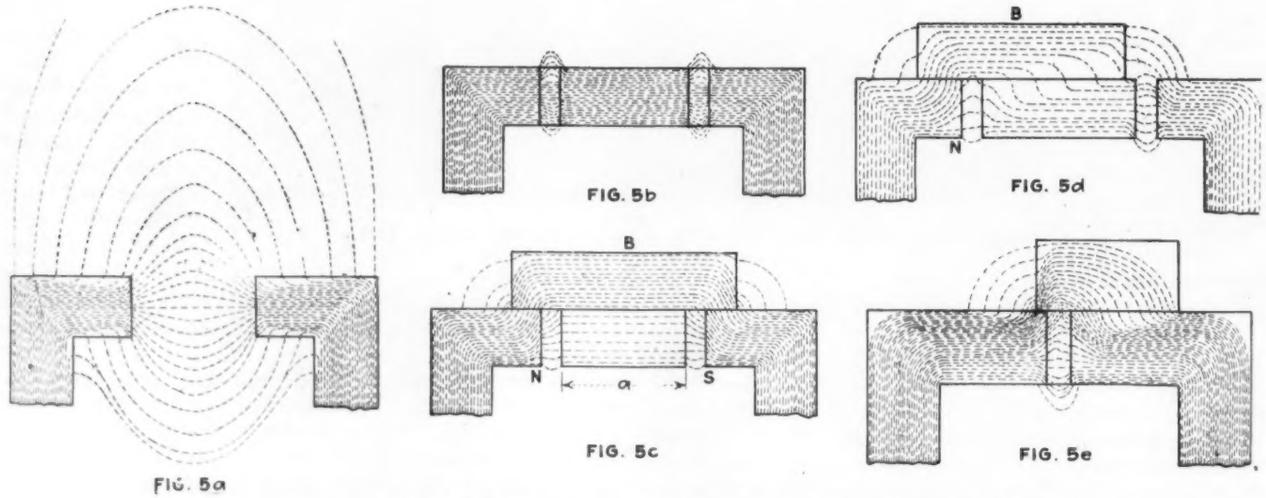


FIG. 5—EFFECT OF AIR GAPS AND PROXIMITY OF IRON ON MAGNETIC FLUX

A—With a wide air gap the magnetic flux will spread and probably magnetize steel in vicinity. B—With a neutral pole between the magnetic poles the leakage is decreased. C—When work *B* bridges poles *N* and *S*, but with a neutral pole also between them, some of the flux is shunted through the neutral pole and hence the pull on *B* is reduced. D—With a piece of work spanning only one air gap the right-hand gap forces some flux to leak away from *B* through the end, thereby reducing the pull. E—When a piece of work is set so that only a small part of it lies on one pole the flux will be so concentrated in this part that some will tend to leak through the air without fulfilling any useful purposes.

as the tool passes over the work will reduce the amount of permanent magnetism left in the machine and the tool, but will leave a certain amount of magnetism after each reversal.

Magnetism should be kept out of the machines and cutting tools as much as possible because magnetized tools accumulate and hold a certain amount of chips and steel dust which rapidly dull the cutting edges. To avoid, or at least to reduce, the shunting of magnetism into the machine or the tool, the chuck can be mounted on a non-magnetic support such as brass. In fact, some makers of magnetic chucks use strips of brass on the bottom of the chuck to accomplish this end.

In the single-pole type of chuck (Fig. 2) the main pole may be cast with the body or separately therefrom. Magnetically, however, the circuit is the same in both cases. The face plate is made up of a grid, the bars of which are cast integral with the body, and the spaces between the bars are filled with projections from a pole piece that fits on top of the main pole of the magnet.

In this type of chuck the body forms one pole and the serrated pole face forms the other. The two parts are held rigidly in proper relation by filling the space with a non-magnetic metal. This chuck has one advantage over the chuck shown in Fig. 3 in that there are no neutral spaces between adjacent poles in the pole face. The disadvantage of this type of construction is that the serrated pole face provides an air gap of short length and very large area, which allows a large portion of flux to leak through the circuit unless the work that is on the chuck covers a considerable area.

While the magnetic circuits of Figs. 2 and 3 are quite similar, the body of the neutral-pole chuck is utilized as a part of the magnetic circuit only to a slight degree, depending upon the work mounted on it, so that the power to magnetize the single-pole chuck is very much greater under the same circumstances. Furthermore, the magnetomotive force that is impressed across the leakage path is greater in the single-pole chuck than in any other because all the magnetomotive force produced in the chuck is impressed across the leakage path, while with the multiple-pole chuck it is impossible to have more than the magnetomotive force produced by one pole impressed across the leakage path.

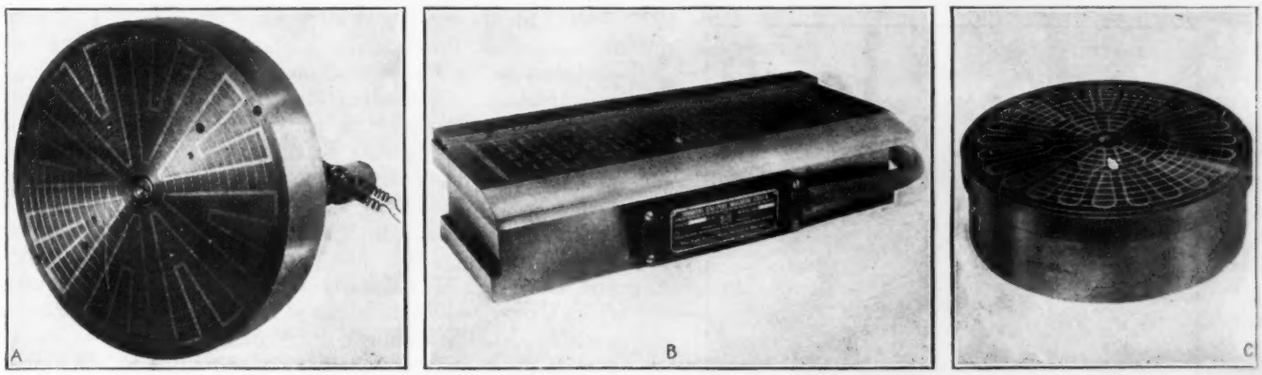
When dealing with small pieces of work care should be taken to place them on the chuck so that equal parts come in contact with opposite poles. If it is placed in such a way (Fig. 5e) that the area over one pole is very much less than that over the other pole, the smaller area is liable to be supersaturated and considerable magnetism will be forced to leak out into the air with consequent ill effect of leakage and a reduction in the pull. Then, too, it shall always be borne in mind that when the permeance of the magnetic circuit is decreased by introducing air gaps or placing the work so that it saturates more in one place than in another the total amount of magnetism produced by the exciting coils in less than when the work is so mounted on the face plate that equal areas are in contact with opposite poles.

From the foregoing it is evident that the single-pole chuck is better adapted to holding large pieces of work than small pieces on account of the fact that the volume of its air gap is so great that considerable loss due to shunting of magnetism results when the pieces of work are small.

FIGS. 9 AND 10—VERTICAL MILLING MACHINE EQUIPPED WITH SINGLE AND MULTIPLE-POLE CHUCKS RESPECTIVELY SHOW DIFFERENCE IN LEAKAGE BY EFFECT ON FILINGS

The unit-pole magnetic chuck, shown in Fig. 4, is a multiple-pole chuck built without the use of neutral poles. The magnetic circuit is inclosed in the body but is entirely separated from it magnetically. The face plate is made up of a series of interlocking pole pieces, opposite poles being immediately adjacent to one another except for the air-gap space, which is filled with non-magnetic metal. The assembled pole pieces are then held in a solid frame which forms part of the body of the chuck.

By mounting the magnetic circuit, *E*, inside of the body, *F*, and separating the two by non-magnetic material at all points of contact there are never any circumstances under which the magnetism will travel through the body of the chuck, and therefore there can be no leakage from this chuck into the machine or the tools. In fact the body of the chuck with this type of construction forms an effective barrier, or screen, for magnetism so that magnetism from inside the chuck cannot get out nor can magnetism from the outside get in.



FIGS 6, 7 AND 8—SINGLE-POLE, MULTIPLE AND NEUTRAL-POLE CHUCKS

On account of the unit construction the magnetism produced in each pole passes into the adjacent pole piece and nowhere else (which means a short path of maximum area), resulting in maximum magnetism and pull in a given space.

By interlocking the pole pieces forces across the chuck as well as along the chuck are resisted, altnough the resistance is much greater at right angles to the poles than across the chuck. It should always be remembered that a magnetic chuck offers no resistance to sliding of an object over its face unless the sliding involves a change in the number of lines of magnetism that pass from any given pole through the work. Of course, the downward pull, which runs from 50 to 150 lb. per sq.in. (3.5 to 10.5 kg. per sq.cm.), resists sliding to the extent that this pull produces friction. With straight parallel pole pieces and pieces of work of comparatively small area the work can be moved parallel to the poles without changing the number of lines of magnetism and the only resistance to such motion would be the friction caused by the downward pull. For this reason it is customary to supply work fingers and end stop so as to prevent sliding of the work as well as to locate the work on the chuck.

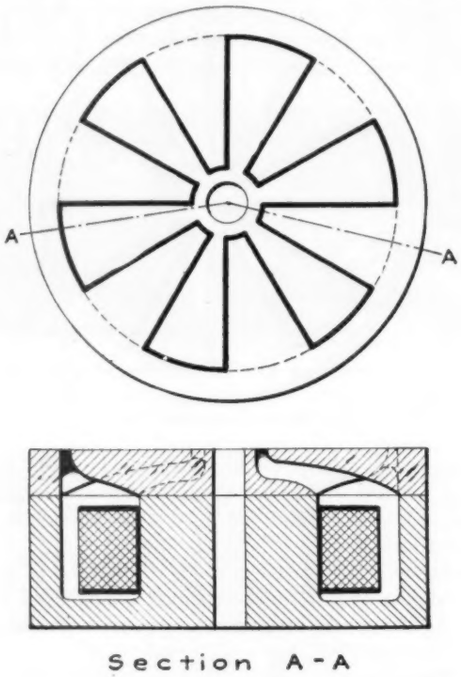


FIG. 11—EXTERIOR AND CROSS-SECTION OF ROTATING SINGLE-POLE CHUCK

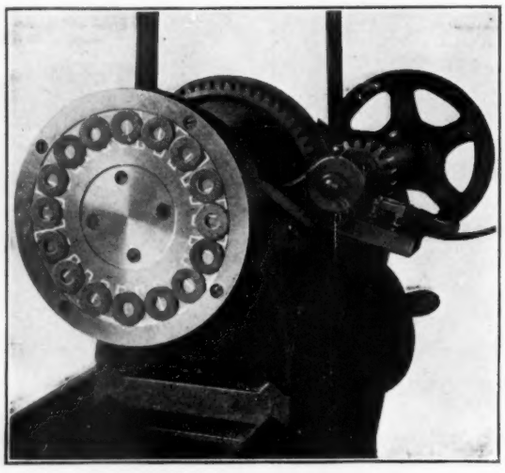


FIG. 12—SINGLE-POLE ROTATING CHUCK LOADED WITH WASHERS FOR SURFACING

In selecting a chuck it is always advisable to get one in which the magnetic leakage is minimum, partly on account of the fact that magnetic leakage is bad for the machines and tools and also on account of the fact that it reduces the effective holding power of the chuck whenever the poles are worked anywhere near the saturation point.

The magnetic chucks which have been described are known as rectangular chucks and are intended for holding work on surface grinders, milling machines, planers, shapers, etc. However, circular chucks are built along the same fundamental lines for holding work that is to be rotated as is the case in some disk grinders, second operation work on lathes, etc. Fig. 11 represents the magnetic circuit of a single-pole chuck. From this illustration it is easy to imagine the construction of multiple-pole and the unit-pole chucks.

Small sizes of rotary chucks are used on light lathes, and therefore excessive weight is objectionable. In cases of this kind the unit-pole construction has an advantage because it enables the use of aluminum instead of cast iron for the body, thus saving considerably in weight.

PIECE NUMBER SYSTEM FOR ELECTRICAL INSTALLATIONS

Applicable to Any Job Erected at a Distant Point As a Ready Means of Identifying and Locating Equipment

BY S. L. GUTHORN
Electrical Engineer, Perin & Marshall

THE following piece-number system, applicable to the design and erection of large industrial plants and power stations, is especially valuable in the case of plants erected at sites far distant from the place of design, as, for example, a plant erected in China but designed in New York and using materials of American manufacture. It assures identification and location of all parts in the plant, as the engineer's own inspector checks the piece number on the article before shipment and his own designer locates it on the plans.

The system is briefly as follows:

Drafting Room.—In the drafting room two card indexes are prepared, one alphabetically cross-indexed and the other numerically indexed. Cards are drawn from a previously numbered set of future piece numbers, each card being duplicated. When a drawing is ready for its piece numbers the article is sought in the alphabetical index, and if there, its piece number is placed on the drawing within a $\frac{7}{16}$-in. (8.1-mm.) circle with a radial arrow pointing to the article. If not there, the next number in duplicate is drawn from the future piece numbers and filled out. An article thus retains its piece number irrespective of where it is placed.

Cards show piece number in upper left corner, a description of the part, its manufacturer, catalog number, dimensions, purpose and where first used. One is filed alphabetically and the other numerically. When a part on a drawing is desired, as indicated by its piece number, its identity is found in the numerical index.

Recorded on the back of the alphabetical index is the material charged to and against stock, obtained from the bills of material and the periodic purchase orders. This shows the condition of stock on the ground, furnishing data for future stock orders.

The specification of a given card must never be changed, except to conform with the material as actu-

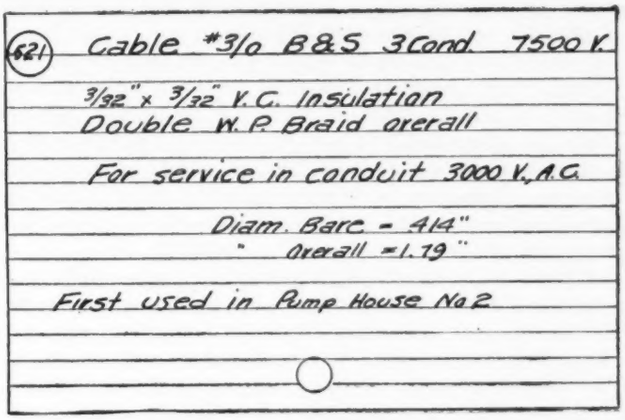

621
Cable #3/o B&S 3Cond 7500 V.
3/32" x 3/32" V.C. Insulation
Double W.P. Braid overall
For service in conduit 3000 V.A.C.
Diam. Bare - .414"
" Overall - 1.19"
First used in Pump House No 2

FIG. 1—PIECE NUMBER, DESCRIPTION, DIMENSIONS, PURPOSE, ETC., SHOWN ON FRONT OF INDEX CARD

ally ordered. If the specification does not conform to a given requirement, a new card is used. Furthermore, cards must never be used except from those previously numbered and reserved as future piece numbers. This reduces the probability of using a given piece number for more than a single article and establishes the last number used.

In the field numbers, ranging from 100 upward, are placed within a circle and attached to an article or its container, as its piece number. Such numbers are placed on the orders for all supplies and miscellaneous wiring materials, devices, cable, etc., excepting switchboards and parts mounted thereon and motors and controllers.

Manufacturers and dealers supplying materials are required to affix piece number, inclosed in a circle, to

To Stock			From Stock			NET STOCK
DATE	ORDER NO.	QUANTITY	DATE	B/M. NO.	QUANTITY	
9-27-17	518	400	12-4-17	419	400	
10-25-18	734	800	9-12-18	607	500	300

FIG. 2—BACK OF CARD SHOWS MATERIAL CHARGED TO AND FROM STOCK

all containers and wherever possible to the articles themselves. No two or more different kinds of articles are permitted in the same container unless each is separately marked. Inspectors are required to check piece numbers before passing for shipment.

Upon receipt at destination, the storekeeper will assort articles by their piece numbers and place in stock bins. Stock bins are to be numbered from 100 to about 1000.

During construction the erector will call upon storekeeper for parts by their piece numbers. The piece number appears on drawings within a circle with arrow pointing to article designated, thus showing its position and location. In general the erector will find provision has been made in the structure for the fastening of the article. Two numbers within a single circle designate related parts, such as the washer to go with a bolt and nut. A letter and a number appearing within an elongated circle represent a drawing or an electrical standard assembly, the pieces entering into which will be found on the drawing. Such assemblies will be made in shops at destination and held in stock bins designated by their drawing letter and number, or, when the enterprise is a new one rather than the extension of an existing plant, they will be shipped constructed.

When the design of the electrical equipment of a given system for a building is completed, two bills of material are issued—one for materials purchased, the other a shop order for construction or fabrication of special work required and the placing of same in electrical stock ready for erection.

CARDS CONTAIN COMPLETE INFORMATION

To identify completely a given article (for present use and future reordering) a duplicate index, alphabetically and numerically arranged, is prepared and sent to the engineer in the field. Full alphabetical indexing, showing names of articles as well as mere letters, is used. These index cards also show the piece number in the upper left corner, a description of the part, its manufacturer, catalog number, dimensions, purpose, etc., and where first used. Additional cards, covering new piece numbers issued, are sent to the field monthly. The cards permit affixing piece numbers to pieces, the numbers of which may have become illegible, lost en route, etc.

Switchboards and parts mounted thereon and parts pertaining to switchboards but otherwise mounted are designated by the manufacturers' summaries, specifications and certified drawings. Materials, designated by switchboard summaries but not mounted on switchboard, are to be identified and their piece numbers attached. All such equipment may then be placed in stock unless calibrated, or otherwise of such a nature as to be applicable only to the particular installation indicated by the summary, in which case it must be piece-numbered and further reserved for the installation required.

Motors and control equipment are designated by equipment schedules of each mill or by manufacturer's order, etc.

THE natural training school in the electric lighting industry is the company section of the National Electric Light Association. The utility and effectiveness of these organizations throughout the country have been so clearly demonstrated as to make comment unnecessary. I am convinced that in the coming years our executives and the leaders in our industry must of necessity come through the avenue of the local company section of the N. E. L. A.—*Joseph B. McCall.*

Expansion of A. I. E. E. Activities Proposed

Transmission, Distribution and Insulation Topics Were Principal Engineering Subjects at Closing Sessions—Proposed Issuing of Engineering Periodical by Institute Caused a Whole Evening's Argument

FEATURES of the first two days' sessions of the Lake Placid convention of the American Institute of Electrical Engineers were presented in last meek's issue of ELECTRICAL JOURNAL. As pointed out there, the convention was unusually successful, not only from a business point of view but because of the unlimited recreation afforded at this beautiful mountain resort. President Adams' retiring address, the discussions on relay practice and grounding the neutral, and a resume of the technical committees' reports appeared in that issue. In the present number will be given an accounting of the concluding sessions, in which featured discussions on cables 220,000-volt transmission, expansion of the technical committees' duties, and the advisability of the Institute issuing a more popularized or generalized periodical in place of the proceedings.

DISCUSSION ON TRANSMISSION DISTRIBUTION TOPICS

Following the presentation of the transmission and distribution committee report by E. B. Meyer on Thursday morning, June 26, considerable discussion took place regarding the dissipation of heat from cables and its effect on insulation. Specifications for paper and varnished cambric insulation are very much needed, said W. A. Del Mar of the Electric Cable Company. In view of the need of securing still greater dissipation of heat from cables, he recommended studying the relative carrying capacities of cables buried in earth directly and in ducts.

The necessity of developing a method by which it can be determined definitely whether cables come up to A. I. E. E. specifications as to heating was emphasized by D. W. Roper, of the Commonwealth Edison Company, Chicago, but P. M. Lincoln, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, expressed the belief that this problem is more that of operators than of manufacturers, because the temperature of cables is affected by loca' conditions. However, there is a chance of coöperation.

Determination of copper temperatures in cables is possible now, says R. W. Atkinson, Standard Underground Cable Company, Perth Amboy, N. J., provided the duct temperature, sheath temperature, cable load, and characteristics are known. However, operating companies should publish more data regarding the duct temperatures, in order that the dissipation of heat from cables may be better studied.

Prof. J. C. Clark, Stanford University, Palo Alto, Cal., said that there is urgent need of funds for research work in order that insulators may be brought up to a higher standard. For the benefit of operating companies, C. B. Martin, New York, suggests that the institute adopt a standard method of testing high-tension insulators.

H. R. Summerhayes, General Electric Company, said that the effect of short-circuit currents on insulation of cables should be carefully considered because the heating may be serious even in a few seconds. As an example of high-voltage cable performance, President Comfort A. Adams called attention to single-conductor cables in Switzerland, rated at 60,000 volt and tested at 100,000 volts a. c. or 200,000 volts d. c.

Research on insulating materials is being conducted coöperatively under the auspices of the National Research Council, said Col. F. B. Jewett, Western Electric Company, the results of which are to be put into the hands of manufacturers to help them meet operators' troubles. The success of this undertaking will depend almost entirely on the coöperation of such bodies as the transmission and distribution committee.

Clifford S. MacCalla, General Electric Company, referred to a rather unusual insulator performance record on the Central Colorado Power Company's system, where link insulators, as distinguished from the cement-pin type, are used. On the 100,000-volt lines where these insulators are used there has been less than one-half of 1 per cent insulator failure, which, if corrected for failures due to lightning, leaves only one-tenth of 1 per cent failure due to aging.

Dr. Charles Proteus Steinmetz, General Electric Company, does not believe that porcelain ages. However, the assembled structure of pin, cement, and porcelain may age because the metal expands and contracts with changes in temperature and the cement characteristics are altered by temperature. No civil engineer would combine these products in one structure, Dr. Steinmetz pointed out.

BROADER FIELD OF ACTIVITY FOR TECHNICAL COMMITTEES

Technical committees can do more than arrange for the presentation of papers, said Wilfred Sykes, chairman of the board committee on technical committees. They can also collect and correlate data, formulate rules, etc. He pointed out that outlining and accomplishing the latter kind of work takes considerable time, hence the present arrangement of allowing committee members to hold office only for one year is not effective and much better results could be secured by continuing committee men in office longer.

This thought was developed in detail by Dr. Steinmetz, who pointed out that the principal value of committees is to give extensive reviews of developments in their particular branch of the industry in such form that general engineers can readily understand them. Other associations, like the National Electric Light Association and the Association of Edison Companies, have found committee reports much more desirable than individual papers; therefore, the Institute's technical committees' duty should be reorganized with this in view. Arrangements for presenting individual papers can be made to assist in compiling the final reviews, which should be considerably longer than the reports now presented. Such an arrangement will broaden engineers who will otherwise confine attention to their specialty. Whatever is done to develop the activities of the technical committees, the "deadwood" should be dropped, and only those who are willing to work

should be kept on the committee, according to Dr. Steinmetz. Professor Parker differed with Dr. Steinmetz regarding the reduction in size of committees, suggesting that committees should consist of more men, some of whom should be younger men now overlooked in the Institute's activities.

The establishment of a research committee to serve as an intermediary between the Institute and the National Research Council was suggested by Prof. V. Karapetoff, to take up individual problems coming before the technical committees. He contended that the great work is not done by technical committees but by individual geniuses, so it is not advisable to dispense with individual papers entirely. Research could also be stimulated by appointing to each technical committee one member who is inclined towards research work.

One of two purposes is open to the A. I. E. E., says David B. Rushmore, General Electric Company: (1) to supply every electrical engineer with the information he wants or (2) to allow specialists to form separate organizations. Therefore, the question is whether the Institute should enlarge its activities and become an inclusive body or confine its attention to those engineers who are not specialists and become a residual body. In the selection of committee men, he favors asking the section chairmen for eligible committeemen, their connections, abilities to do work, etc., and then to keep a periodic record of each committeeman's performance, so that replacements can be made by more active members if necessary.

Another method of assuring continuity of purpose and activity in the technical committees would be to select each chairman from the preceding committee, and choose the remaining members on the basis of their former activity, said L. W. Chubb, Westinghouse Electric & Manufacturing Company.

Among others who discussed the subject of committee activity were E. B. Meyer and Comfort A. Adams.

FEASIBILITY OF 220,000-VOLT TRANSMISSION DISCUSSED

Concrete Opportunity for Application Along Northeastern Seaboard to Come Before Congress—Conservation of Coal and Freight Congestion

The results of a detailed investigation to determine whether 220,000-volt transmission is economically and technically feasible in the near future were presented quite fully in last week's issue of ELECTRICAL WORLD. The opinion there expressed by A. E. Silver of the Electric Bond and Share Company was that such high-voltage transmission is immediately possible. In this belief he was supported by numerous speakers at the Lake Placid convention of the A. I. E. E. last week, where the paper was presented, although certain problems which are not fully solved were pointed out and attention called to further research that is necessary to meet the requirements of such transmission in the best manner.

A concrete opportunity for application of this high voltage was cited by W. S. Murray, formerly electrical engineer of the New Haven Railroad and conservation engineer for the government, who referred to a superpower line which is proposed between Washington and Boston to serve a territory measuring about 450 miles (724 km.) long by 150 miles (241 km.) wide. Details of his remarks will be published later.

In considering the paper, by A. E. Silver, previously mentioned, several speakers expressed themselves in favor of the grounded Y-connection, questioned the advisability of eliminating line protection entirely, and raised objections to high-tension switching. Others who spoke questioned the advisability of eliminating spare transformers, suggested the use of link insulators instead of cement-and-pin type, expressed the opinion that use of fifteen disks in series on a grounded line is unduly conservative, and mentioned factors that become important at high voltages.

Among those taking part in the discussion were Philip Torchio, A. F. Bang, Prof. J. C. Clark, S. W. Mauger, R. M. Spurck, F. W. Peek, Jr., F. C. Hanker, G. I. Gilchrest, R. P. Jackson, H. B. Dwight, J. F. Peters, Prof. C. F. Harding and F. F. Brand.

Operation of 220,000-volt transmission lines without spare transformers is considered unwise by A. F. Bang, Pennsylvania Water Power Company, Holtwood, Pa., who favors single-phase transformers in preference to large three-phase transformers for this service. He also questioned whether external cooling of transformers is justified in every case.

F. W. Peek, Jr., expressed the belief that a line built according to the plan outlined in Mr. Silver's paper would be more reliable than present 33,000-volt lines, and that link-type insulators will overcome most objections to insulators, since they show very little depreciation even when made of poor porcelain.

Several factors which are of no consequence at low potentials become serious in the design of high-voltage apparatus, pointed out J. F. Peters, Westinghouse Electric & Manufacturing Company, one of them being the electrostatic field. Short-circuit stresses will not be so severe on high-tension transformers because of the greater magnetic leakage. Some difficulties will be involved in transporting and handling the apparatus in sizes such as will be required. While some speakers inferred that there might be less insulation on the grounded end of Y-connected transformers, Mr. Peters pointed out that there should not be less insulation between turns, because just as great if not more voltage is impressed there.

PROBLEMS ENCOUNTERED IN CABLE OPERATION AND DESIGN

Single Versus Multi-Conductor Cables for Polyphase Circuits and Dielectric Field Determination Elicits Considerable Discussion

Two papers on timely phases of cable design and operation were presented and discussed by a number of members. One paper was on "High-Tension Single-Conductor Cable for Polyphase Systems" by W. S. Clark and G. B. Shanklin; the other was on "The Dielectric Field in an Electric Power Cable," by R. W. Atkinson. Mr. Shanklin said that there is a big opportunity for the development of single-conductor cables rated at 58,000 to 88,000 volts, but there may be problems of manufacture, delivery and installation that cannot be handled by present facilities. For such voltages the diameters would range from 3¾ in. to 5¾ in. (9.5 cm. to 14.6 cm.), and the sheath loss would be less than with lower voltages. By using alloy sheathing of greater strength and thinness, other improvements can be expected.

R. W. Atkinson declared that improvement in the filler spaces of the ordinary three-conductor cables has not in the past kept pace with improvement in insulation near the conductors, and probably it cannot do so in the future. Doubtless, therefore, stresses in this portion of the cross-section will become more and more the limiting condition in cables of this class. Considerable data were obtained by the author by means of electrodes in an electrically conducting liquid, used to stimulate a homogeneous dielectric.

DISCUSSION

Among those taking part in the discussion of the two foregoing subjects were H. W. Fisher, Standard Underground Cable Company, Perth Amboy, N. J., W. A. Del Mar, Electric Cable Company and Habirshaw Electric Cable Company, New York, D. W. Roper, Commonwealth Edison Company, Chicago, Philip Torchio, New York Edison Company, H. L. Wallau, Cleveland (Ohio) Electric Illuminating Company, and the authors of the papers.

Mr. Del Mar presented a diagram showing lines of electric force and heat flow around both round and sector-type three-conductor cables. By means of these it was shown that the dielectric stress is about 15 per cent greater in the round-conductor cable than in the sector cable, and that the points of maximum stress lie on the line joining the nearest points of the conductors. Furthermore, the average length of the lines of heat flow in a sector cable are about 10 per cent greater in a round-conductor cable than in a sector cable.

As the heat-dissipating surface of a sector cable is about 10 per cent less than that of a round-conductor cable, and as about two-thirds of the heat resistance between conductor and air is in the insulation and one-third at the surface of the sheath, it follows that the heat resistance from conductor to air of the sector cable is about 3 per cent less than that at a round conductor cable. Hence the carrying capacity of a sector cable will be from 1 to 2 per cent greater than that of a round conductor cable. The tests from which these observations were obtained were made by the electrolytic method.

In Mr. Torchio's opinion, Messrs Clark and Shanklin went too far in saying that single-conductor cable is more advantageous than three-conductor cable, since the better thermal distribution of sector cable compared with round-conductor cable would make is better than single-conductor cable. Single-conductor leaded cable has several disadvantages, among them being the higher voltage impressed in the sheath in case it is not grounded.

If the sheath is grounded, the charging current will be very high. If the load currents reach high values the mechanical stresses will be very severe in manholes and other places where the cables cannot be substantially braced.

Specific information regarding the sheath current and induced voltage was given by Mr. Wallau, who said that in a test on two 100-ft. (30.5 m.) lengths of 1,000,000 circ.mil single-conductor cable placed 26 in. (66 cm.) center-to-center, the sheath current was 225 amp. and the induced voltage 95 volts, with 60-cycle 650-amp. current flowing in the cable. Grounding the sheath at the mid-point through 0.3 ohm would have helped, but space was not available, so non-leaded cable was used instead.

PROPOSED CHANGES IN A. I. E. E. ACTIVITIES

Issuing of Engineering Periodical Instead of Proceedings Arouses Considerable Discussion—Other Proposals Widen Activities

Proposals to modify and extend the present activities of the American Institute of Electrical Engineers were presented by the Development Committee and discussed *in extenso* by the convention delegates. The principal proposals, as explained by Calvert Townley, chairman of the Development Committee, were to substitute an engineering periodical for the present monthly Proceedings, to create geographical sections which will be represented by vice-presidents, to rotate the meeting places instead of holding the monthly meetings in New York City, to decentralize committee work and carry it on through the local sections, to federate local engineering which would be coördinated under a national council, to hold a regular engineering congress.

In supplanting the monthly proceedings it would be the purpose to eliminate the publication of Institute papers except those presented before the general meetings and substitute abstracts of every paper presented in sections. In addition, the committee contemplated including general engineering articles and abstracts of papers before allied associations. Advertising would be solicited, part of the revenue from which would go to offsetting the expense of publishing the engineering periodical, and the rest would be allocated to the sections. The Transactions would still be continued. According to the proposals, the officers' and board members' traveling expenses would be paid when attending meetings and vice-presidents would be required to visit the sections in their territory at least once a year. Furthermore, the vice-presidents' tenure of office would be increased to two years and no member would be allowed to hold office more than six years.

In the discussion regarding the publishing of an engineering periodical, two viewpoints were expressed. One proposed the popularization or generalization of engineering information presented in the monthly publication to stimulate the interest of the younger members of the Institute; the other deplored the duplicating of existing engineering periodicals and a lowering of the prestige of the Institute by publication of lower caliber articles than are now presented. Many objected to soliciting advertising. Among those taking part in the discussion were Prof. W. I. Slichter, Columbia University; F. M. Feiker, McGraw-Hill Co., Inc.; Dr. Charles P. Steinmetz, General Electric Company; M. Alexander, General Electric Company; R. M. Cushing, General Electric Company of Boston; David B. Rushmore, General Electric Company, Schenectady; H. C. Dean, New York & Queens Electric Light & Power Company, Long Island City; John C. Parker, University of Michigan, Ann Arbor; H. B. Vincent, Day & Zimmerman, Philadelphia; W. A. DelMar, Electric Cable Company and Habirshaw Electric Cable Company, New York; L. W. Chubb, Westinghouse Electric & Manufacturing Company, Pittsburgh; L. T. Robinson, General Electric Company, Schenectady; Prof. V. Karapetoff, Cornell University, Ithaca, N. Y.; Prof. C. F. Harding, Purdue University, Lafayette, Ind.; J. E. Fries, Tennessee Coal & Iron Railroad Company and Chickasaw Shipbuilding Company, Birmingham, Ala.; Prof. Comfort A. Adams, Harvard University; Prof. Charles F.

Scott, Yale University; Philip Torchio, New York Edison Company, New York; Commander Clyde S. McDowell, Charles L. Perry, General Electric Company, Schenectady, and H. Logan, New York City.

Three criticisms of the present monthly publication were pointed out by Professor Slichter, chairman of the committee on publications. (1) A great many papers are not of interest to readers but some are needed for reference in future, so nothing must be done to reduce the opportunity afforded for referring to these at present; (2) the lapse of time between presentation of papers and discussions is too great; (3) the enormous cost of duplication in proceedings and transactions, which he believed would be overcome by the proposed change without distracting from the present value of proceedings. Of course the editorial staff would have to be increased, and advertising solicited to cover expenses.

Mr. Feiker stated that as he understood the proposals of the Development Committee, it is the purpose of the Institute to appeal to the interest of the younger members by presenting more popularized or generalized articles. Without questioning the advisability of doing this, he asked the delegates attending the meeting whether they realized that such a publication would be duplicating the functions of existing publications. Mr. Feiker also called attention to the greatly increased expense which would be involved by issuing such a publication, and said that maximum use is not made of present publications to help the Institute.

Dr. Steinmetz said that he would be very sorry indeed to see the size and quality of the Proceedings changed after appearing in their present form for 35 years. In his opinion the proposed plan will lower the prestige of the Institute, and soliciting advertising will make the Institute dependent on advertisers. Part of the $18,000 now expended in binding the Transactions can be saved, in his opinion, without adopting the radical steps proposed. The present Proceedings are the only things that some members get out of the Institute. Dr. Steinmetz emphasized that the question of securing more revenue should not be the basis for changing the character of the proceedings for such a policy would be suicidal, and that the Institute should consider very seriously the result of publishing a popular engineering magazine that would appeal to a miscellaneous group of readers.

In expressing the viewpoint of younger engineers, Mr. Dean said that he does not read all the papers in the Proceedings, but does refer back to the Transactions many times. The Proceedings could probably be made more interesting to the younger members by presenting the material in a different form, but he did not believe that the Institute should attempt to duplicate present engineering publications. If it costs so much to secure the younger engineers as members of the Institute, he said he did not believe it was worth the expense.

As a method of increasing the revenue of the Institute, Mr. Vincent proposed elevating the membership of those persons now below the rank to which they are entitled. In this suggestion he was supported by Professor Clark, who also suggested that the cost of binding Transactions should devolve upon the members.

If popularized or generalized papers are to supplement the present technical ones, it is difficult to see how the latter can be accommodated in a monthly publication, said Mr. Chubb, who expressed the opinion that he would be very sorry to see a reduction in the present type of technical papers.

Mr. Robinson contended that it was not the intention to parallel the work of existing engineering periodicals. He declared that the Institute papers are the most interesting part to members at present and should not be contracted. "Young engineers," he said, "do not have to be attracted by popular articles."

It would be suicidal to extend the functions of the Institute downward, said Professor Karapetoff, who took a decided stand that the present high standing should be maintained. More popularized or generalized engineering information is not needed, he said, because the present engineering publications meet this need. In view of the fact that the proposed publication would have to compete with similar publications issued by shrewd, skilled business publishers having comparatively stable personnels, he suggested that the feasibility of publishing such a magazine as the Development Committee proposed be studied by a committee made up of publishing experts. The motion was seconded by Mr. Fries, who emphasized the importance of considering the financial side, but President Adams said that the passage of such a motion would in effect be a vote of lack of confidence in the Development Committee. The motion failed to pass.

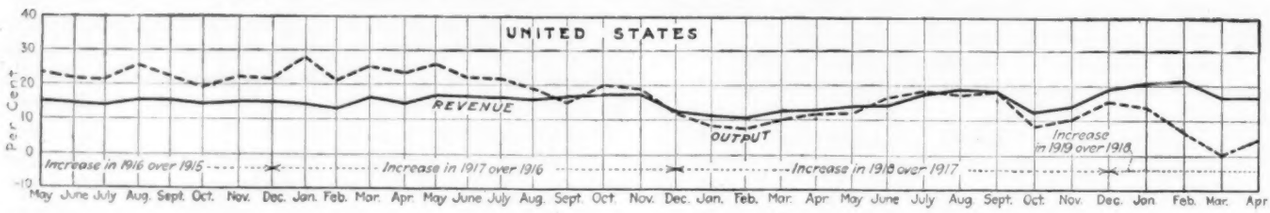
DR. STEINMETZ OUTLINES AMBITIOUS PROGRAM

"Mathematical and theoretical papers are the ones which give a prestige to the Institute, and permanent value to the transactions," said Dr. Steinmetz. All agree that the papers presented should be of the highest caliber, and therefore the modified monthly proceedings should report every advance in electrical engineering, give the present status of the industry, and abstract all contemporary literature. Theoretical and experimental investigations, inventions, discoveries and developments, and operation and installation of equipment, which may constitute a step in advance and should also be subjects of discussion. Resumés of different phases of electrical engineering could be included to advantage for the benefit of engineers who specialize in one particular branch. Individual reports alone are not suitable, and should be supplemented by a committee report to keep the constituents interested. It would be of immense value to members, said Dr. Steinmetz, if all papers of affiliated societies would be made available in condensed form by their author. Arrangements for such abstracts might be made by mutual agreements with other societies. These abstracts might also be used as a basis for accepting papers.

Following these remarks a vote was taken, to accept the proposals regarding an engineering publication submitted by the Development Committee. President Adams then said he greatly favored the suggestions given, but was aware that great expense would be involved to secure men of sufficient caliber to undertake the program outlined. The chairmen, as well as Mr. Torchio, expressed themselves as opposed to including advertising in the Institute's proceedings.

The remainder of the proposals of the Development Committee were accepted and referred to the Board of Directors for action. The subject will not necessarily come up before the membership again, except as the Board of Directors sees fit to secure a referendum vote. However, opportunity is afforded for sending in written discussions regarding any of the proposals.

Central-Station April Operations


UNITED STATES
REVENUE
OUTPUT
Per Cent
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
Increase in 1919 over 1918
May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr

THE RECORD OF OUTPUT "CAME BACK" WITH A GAIN OF 4.8 PER CENT OVER APRIL, 1918

APRIL returns show improvement in output over the record of March. That is to say, they indicate a gain of 4.8 per cent over April, 1918. March, according to the preliminary central station statistics printed a month ago, registered the small decline of 0.1 per cent below March, 1918, but the later figures in this issue of the ELECTRICAL WORLD improve on that record. The March record, revised in accordance with the later returns representing 56 per cent of the industry, is an increase of 0.6 per cent over the corresponding month of the previous year. In either case the difference above or below the line was very slight and it is perfectly clear that the reduction in consumption from war industries was substantially overcome by the increase in demand from the growing peace industries of the country.

It will also be observed from a glance at the returns that April, like March, showed a gain in revenue which means that the same characteristics of operations that have been prominent since the fall of last year are continuing. At that time the curve of the rate of increase in revenue rose definitely above that of the rate of increase in kilowatt-hour output. Under the conditions prevailing generally in the industry prior to the war the rate of increase in output was generally higher than the rate of increase in revenue. These conditions continued, in fact, until September, 1917, when the revenue curve in the ELECTRICAL WORLD statistics crossed the output curve. For a year thereafter the curves crossed and re-crossed but finally separated. Increased cost of operation due to the war conditions was borne by the central station companies for a long time before rate changes were asked, and a still longer period elapsed before increases were authorized by public service commissions. In some conspicuous instances rate increases were not asked. Now with the war over the companies are not experiencing the decline in abnormal costs which they had hoped would develop. It is therefore logical that rates should remain up.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1918	1917	Per Cent Increase	1918	1917	Per Cent Increase
May	62	$25,365,000	$22,426,000	13.1	1,537,527,000	1,297,843,000	11.5
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,372,935,000	11.9
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,319,444,000	16.0
Aug.	61	26,891,000	22,690,000	18.5	1,647,510,000	1,156,692,000	18.5
Sept.	60	28,051,000	23,810,000	17.8	1,579,149,000	1,417,150,000	16.3
Oct.	56	26,254,000	23,228,000	13.0	1,517,866,000	1,348,820,000	17.0
Nov.	57	29,883,000	25,894,000	15.4	1,528,836,000	1,392,359,000	9.0
Dec.	56	32,058,000	27,128,000	18.1	1,539,161,000	1,383,747,000	10.5
		1919	1918		1919	1918	
Jan.	57	33,294,000	27,589,000	20.6	1,522,660,000	1,369,542,000	12.3
Feb.	54	28,130,000	23,162,000	21.4	1,249,806,000	1,157,275,000	7.9
Mar.	56	26,746,000	22,867,000	16.9	1,284,100,000	1,275,893,000	0.6
Apr.	49	21,204,000	18,128,000	16.9	962,967,000	919,276,000	4.8

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1918	1917	Per Cent Increase		1918	1917	Per Cent Increase		1918	1917	Per Cent Increase		1918	1917	Per Cent Increase
REVENUE	May	62	$2,810,000	$2,530,000	11.1	64	$9,929,000	$8,613,000	15.3	53	$8,217,000	$6,956,000	18.1	83	$4,805,000	$4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824,000	19.0	84	4,973,000	4,432,000	12.2
	July	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug.	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	51	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sept.	64	3,268,000	2,811,000	16.2	57	10,143,000	8,631,000	17.5	51	9,251,000	7,703,000	20.1	86	5,389,000	4,665,000	15.5
	Oct.	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov.	64	3,695,000	3,238,000	14.1	55	11,877,000	10,400,000	14.2	50	9,277,000	7,704,000	20.4	81	5,034,000	4,552,000	10.6
	Dec.	64	4,097,000	3,449,000	18.7	55	11,927,000	10,199,000	16.9	50	10,781,000	8,836,000	22.0	79	5,253,000	4,644,000	13.1
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	4,253,000	3,443,000	23.5	60	13,444,000	11,168,000	20.3	47	10,410,000	8,484,000	22.7	77	5,187,000	4,494,000	15.4
	Feb.	63	3,895,000	3,048,000	27.7	53	10,894,000	8,943,000	21.8	45	9,305,000	7,484,000	24.3	73	4,036,000	3,618,000	11.5
	March	63	3,573,000	3,008,000	18.7	52	9,943,000	8,727,000	13.9	47	9,012,000	7,447,000	21.0	81	4,218,000	3,685,000	14.4
	April	55	2,983,000	2,553,000	16.8	44	8,501,000	7,567,000	12.3	41	6,642,000	5,462,000	21.6	74	3,078,000	2,546,000	20.8
			1918	1917			1918	1917			1918	1917			1918	1917	
KW.-HR. OUTPUT	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug.	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	51	447,829,000	399,278,000	12.1	85	488,433,000	413,350,000	18.1
	Sept.	64	133,901,000	114,279,000	17.1	57	520,312,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct.	63	139,784,000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov.	64	138,559,000	123,033,000	12.6	55	542,699,000	495,812,000	9.4	50	444,012,000	396,665,000	11.9	81	403,566,000	368,237,000	9.6
	Dec.	64	145,543,000	129,838,000	12.1	55	4.5,253,000	421,973,000	12.6	50	489,864,000	443,544,000	10.4	79	428,906,000	374,187,000	14.6
			1919	1918			1919	1918			1919	1918			1919	1918	
	Jan.	63	143,254,000	124,632,000	14.9	60	525,322,000	458,545,000	14.5	47	463,394,000	403,127,000	14.9	77	390,690,000	371,156,000	5.2
	Feb.	63	128,660,000	109,993,000	17.0	53	406,702,000	374,958,000	8.4	45	426,965,000	378,912,000	12.6	73	287,479,000	293,492,000	−2.0
	March	63	123,044,000	121,248,000	1.4	52	387,751,000	399,074,000	−2.8	47	442,591,000	423,802,000	4.4	81	330,714,000	331,769,000	−3.0
	April	55	106,979,000	102,165,000	4.7	44	306,708,000	299,371,000	2.4	41	321,906,000	301,753,000	6.6	74	227,374,000	215,987,000	5.2

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STEAM VERSUS AIR FOR SOOT-BLOWING PURPOSES

Air at 100 Lb. Pressure Fails to Remove Soot from Far Side of Boiler, Whereas Steam at 150 Lb. Efficiently Cleans All Parts

By operating boilers at the same capacity subsequently to soot blowing by both air and steam at different times, engineers of the McKinney plant of the Texas Power & Light Company found that a 20 deg. Fahr. (11 deg. C.) difference in stack temperatures was indicated in favor of the latter. When air was used at 150 lb. pressure for blowing the boilers (10.5 kg. per sq.cm.) the stack temperature averaged 500 deg. Fahr. (260 Deg. C.) for the succeeding twenty-four hours.

On the other hand, using air at 100 lb. pressure (7 kg. per sq.cm.) resulted in average stack temperatures of 520 deg. Fahr. (271 deg. C.), although the boilers were operated under the same requirements.

It was found that in blowing with air it was difficult to remove the soot from the furthest wall of the furnace. This might have been accomplished by higher air pressure; however, the compressor used was already being worked very close to its maximum capacity.

OPERATION AT LOW FREQUENCY CAUSES TRANSFORMER BURN-OUT

Reduction of Applied Voltage Would Have Avoided Damage, but Rated Frequency of Units Was Overlooked When They Were Installed

Reactance may be considered as effective as resistance in opposing current. In alternating-current circuits the extent to which it governs the value of the current depends on the frequency; the lower the frequency at a given voltage the greater the current that will be maintained in the cricuit. It follows, then, that if a device is designed to operate on a 60-cycle circuit, it will be liable to overheat if operated on a 40-cycle circuit, unless the voltage is correspondingly decreased.

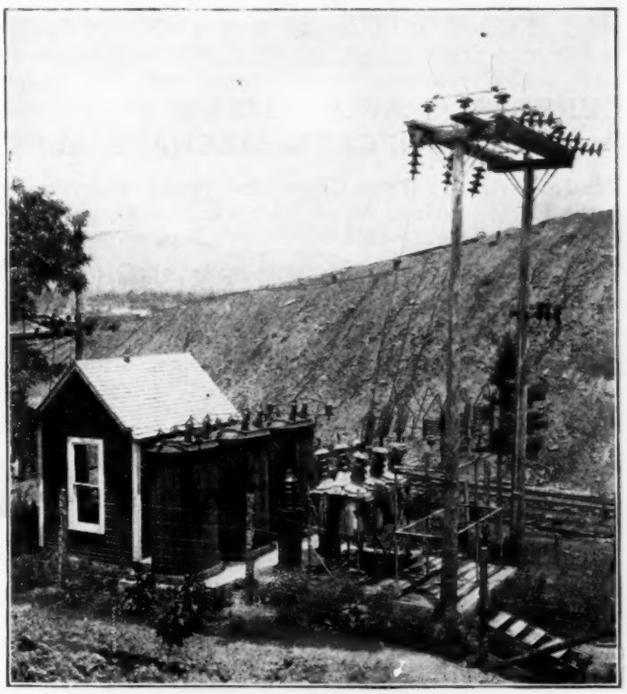
This fact was brought out in a practical way when several second-hand units from a reputable dealer were put in service. Some of the name plates that had been inspected indicated the transformers to be of the required frequency—40 cycles. Three of them, however, had been shipped directly to a remote part of the system without inspection or test. Some days after being connected they burned out one after the other, and it so happened that each burn-out occurred during a lightning disturbance, so the failures were attributed to lightning. Lightning might have been the immediate cause of failure, but when the transformers were brought in for repair it was noticed that they were smaller than the other transformers of the same make and presumably of the same rating. Inspection of their name plates disclosed that they were 60-cycle transformers which had been shipped by mistake.

Brooklyn, N. Y. J. A. HORTON.

HIGH-TENSION SUBSTATION FOR SUPPLYING SMALL TOWN

Terminus of Transmission Line Made of Framework on Two Poles—Circuit Breakers, Transformers, etc. on Concrete Base

For supplying energy to a small town a Southern transmission company constructed a simple 33,000/2200-volt substation with all apparatus placed outdoors ex-



AIR-BRAKE SWITCH CAN BE OPERATED FROM THE GROUND

cepting the metering and control apparatus. A manually operated three-pole air-break switch was installed on two wooden poles, the operating mechanism being so designed that the switch can be opened and closed from the ground level. The oil-circuit breakers, lightning-arrester frame and three 300-kva., 33,000/2200-volt, single-phase oil-cooled transformers are supported on concrete bases. Connected directly in the leads from the air-break switch to the circuit breakers are the suspension-type choke coils. Control boards equipped with meters and necessary distribution switches are installed in the wooden house shown in the illustration.

Chicago, Ill. W. H. YOUNG.

INCREASING ECONOMY BY FEED-WATER REGULATION

Eliminates Time Spent by Water Tender in Regulating Supply by Hand and Increases Average Feed-Water Temperature by 33 Deg. Fahr.

An average increase from 177 deg. Fahr. (80 deg. C.) to 210 deg. Fahr. (99 deg. C.) in the feed-wabeen effected in one power plant by the installation of a Copes boiler-feed regulator. There is now practically no fluctuation in the temperature and it is maintained uniformly high. Before the installation of the regulator the temperature fell as low as 125 deg. Fahr. (51 deg. C.). It was estimated that a saving of 3 per cent of fuel was effected by the regulator.

Because of improper regulation the full amount of heat was not utilized, but now with the regulator bulb installed in the heater vent any escape of steam immediately causes the steam supply valve to close. The bulb of this regulator is installed in the heater vent and in the heater outlet as is usually done. Furthermore, there is no necessity for the water tender to be constantly on the watch and he needs only casually to assure himself that everything is in proper working order.

CURRENT TRANSFORMERS WRECKED MECHANICALLY

Tended to Form True Circle and Broke Away from the Enclosing Iron Which Forms Part of Magnetic Field—Did Not Catch Fire

Usually when short circuits occur in lines in which current transformers are installed the heavy current causes the insulation to be destroyed by fire. This did

COIL BROKE AWAY FROM INCLOSING IRON

not happen, however, when a short circuit occurred a few feet beyond a current transformer in one of the substations of the Southern California Edison Company.

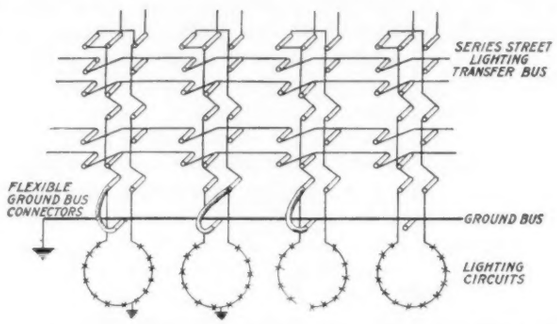
In fact, an enormous strain was placed on the 8-in. by 16-in. (19-cm. by 38-cm.) oblong coil which set up stresses that tended to form the coil into a true circle. The upper part of the coil broke away from the inclosing iron which forms part of the magnetic field. The complete wreck of the transformers is shown in the illustration.

F. B. LEWIS.
Superintendent Los Angeles District.

LOCATING TROUBLE ON SERIES LIGHTING CIRCUITS

Method Used in Chicago Saves Time in Locating Grounds and Crosses and Sometimes Assists in Locating Open Circuits

The ordinary methods of locating open circuits, grounds and crosses, etc., on series street-lighting circuits have resulted in such a great loss of time and



SHOWS POSITION OF GROUND BUS AND FLEXIBLE CONNECTORS

service in Chicago that the engineers have searched for quicker and more reliable methods.

An investigation of the properties and potential gradients of the various series circuits was made by the Lincoln Park Commission, and it was found that on ground connections no dangerous pontential would be developed if the system was properly handled. The relation of lamps with respect to the circuit was determined by placing a ground in the approximate electrical center of the circuit and operating the circuit with a ground on the alternate sides at the switchboard. The number and the location of lamps on each leg were plotted to give a true circuit diagram.

To facilitate testing, disconnecting potheads were placed with jumpers at the electrical centers of each circuit, the cable sheath being bonded across the break. The same type of pothead was also installed at the feeding points of all closed loops so that the circuit could either be operated as a straight circuit, with or without the loops, or could be looped back at such points.

The process of testing may be briefly outlined as follows: The unusual behavior of any circuit causes it to be cut out and a low-tension test indicates, say, a dead ground. If the disturbance gives a stronger indication on the right than on the left, it would indicate that the fault is nearer the right end of the circuit. The right is then grounded to the bus and the circuit cut in on the secondary of a regulated transformer which puts out lights between grounds but allows remainder to burn.

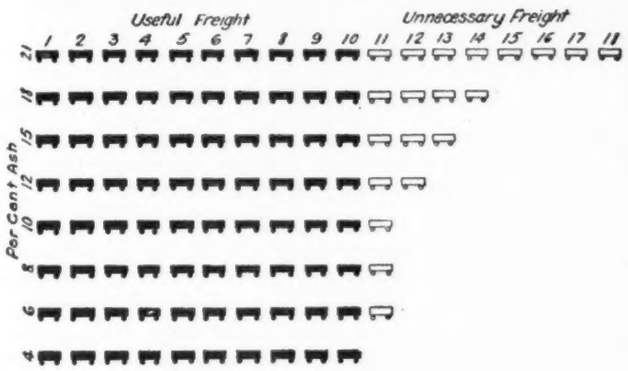
The location of a cross requires practically the same procedure whereas an open circuit requires special treatment. In most cases an open circuit is accompanied by a ground at the point of opening. Occasionally, no ground appears in which case it is necessary to apply a break-down test which usually breaks the circuit to ground at the open.

HIGH ASH IN COAL INCREASES TRANSPORTATION EQUIPMENT

Coal Mined Averages 10 Per Cent Ash—Transportation of Non-Combustibles Requires Additional Equipment, Increasing Price and Causing Delay

As about 85 per cent of all the coal mined in this country is carried by the railroads, unnecessary ash means increased cost and delay in transportation. Each per cent of avoidable ash adds to the work of the railroads about 5,000,000 tons of unnecessary freight per annum. There is a difference between preventable and non-preventable non-combustible in coal the latter being so thoroughly incorporated with the structure of the coal that it cannot be separated mechanically. This minimum ash content differs in each mine.

By preventable ash is meant the slate and other impurities which can be separated by careful preparation. This minimum ash varies from as low as 2 per cent in



COMPARATIVE NUMBER OF CARS FOR COAL CONTAINING DIFFERENT PERCENTAGES OF ASH

some cases to as high as 33 per cent in other cases. The average for the country is probably about 9 or 10 per cent. The number of cars in the chart shows the relative number of cars necessary to carry coals of varying degree of ash.

This information was taken from a report of the engineering committee of the National Research Council to the National Coal Association as prepared by The J. G. White Engineering Corporation of New York City.

EFFICIENT SERVING OF AN ELECTRIC WELDING LOAD

Tests on Circuits Carrying Different Numbers of Machines Show What Transformer Capacity Is Needed Under Different Conditions

Experience with the operation of a large number of spot welders of various sizes indicates that the average spot welder in use to-day has a rating of from 30 kva. to 45 kva. Such a machine draws a momentary load of about 200 amp. on the supply circuit each time it is operated. The length of time which the load is carried is quite variable, but it is usually reckoned in seconds or fractions of a second. Owing to its abrupt character and its short duration, this load is difficult to handle when it is considered from the standpoint of good circuit regulation. Proper regulation under these conditions can be accomplished only by the installation of sufficient transformer and line capacity.

Since the average power factor of an electric welding circuit is between 45 per cent and 50 per cent lag, it is necessary to make provision for this large amount of wattless current in determining the sizes of transformers, lines and other equipment.

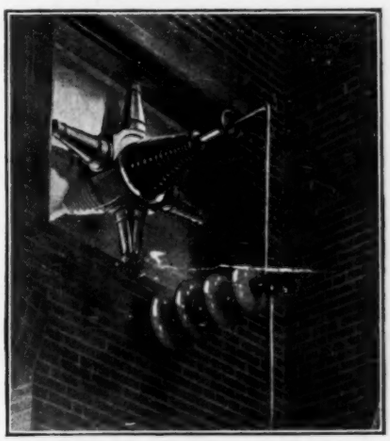
In installations of several welders on a single circuit, however, there is a considerable diversity factor between the total maximum load of the circuit and the total rated capacity of the welders in use. To determine this diversity factor, ratings were taken on a welder circuit on which four machines of various sizes were in operation. The total rating of the four machines amounted to 544 amp., while the capacity of the highest loads observed on the circuit was 330 amp., giving a diversity factor of 1.65 per cent. A second set of readings were taken on another circuit supplying three welders with a total rating of 460 amp. With these machines in operation the average high loads observed on the circuit amounted to 288 amp., giving a diversity factor of 1.6 per cent.

If sufficient rating at the power source is not installed for machines on the line, the drop in voltage during heavy loads will be excessive, making it impossible to secure uniform welds. When the voltage is low a longer time is required to make the weld and if the voltage is high the steel will be burned, thus producing a defective weld so that the regulation should be kept within conservative limits for good welding conditions. To get the best conditions the voltage of the supply circuit should be regulated to within at least 10 per cent

OUTLET WALL BUSHING FOR 110,000-VOLT LINE

Placed in Opening in Brick Wall and Held by Four Legs at Right Angles to One Another—Can Be Easily Replaced in Case of Accident

In a power plant in Canada wall bushings are accommodated by leaving a square window near the top of a wall of the building so that the bushing could be in-



BUSHING PLACED IN SQUARE OPENING IN WALL

stalled at convenience. Four pin insulators attached to the bushing at right angles hold it rigidly in the center of the opening. A glass placed at one side of the bushing prevented wind and rain from entering the building. The outgoing or incoming lead, as it may be, runs parallel to the wall and is held by a pin insulator as shown.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

CHARGING RATES FOR LEAD AND ALKALINE BATTERIES

Schedule of Rates for Two Makes of Batteries Based on Recommended Practice—Start, Finish and Boosting Rates Given

Nearly every battery user or charger has his own ideas of the rate at which to charge batteries, but unless they conform with recommended practice the best results will not be obtained. While nickel-iron alkaline cells—or, as they are better known, Edison cells—are said not to be much affected by the rate at which they are charged, wrong charging of lead cells may cause

CHARGING RATES FOR LEAD AND EDISON STORAGE BATTERIES

CHARGING RATE TABLE—LEAD BATTERIES

No. of Plates per Cell	MV Ironclad Exide and MVY Exide			MV Hycap Exide			MV Thin Exide		
	Start	Finish	Boost	Start	Finish	Boost	Start	Finish	Boost
7	19	8	40	..	..	...	..	..	..
9	24	10	50	21	8	40	17	7	35
11	30	12	60	24	10	50	21	8	45
13	35	14	70	30	12	60	24	10	50
15	40	16	80	34	14	70	28	11	60
17	45	18	90	38	15	80	31	12	70
19	51	20	100	43	17	85	35	14	70
21	56	22	100	47	19	90	38	15	75
23	60	24	100	52	21	100	42	17	80
25	65	26	100	56	22	100	45	18	90
27	70	28	100	..	..	...	49	20	100
29	75	30	100	65	26	100	52	21	100
31	80	32	150	..	..	...	56	22	100
33	85	34	150	74	30	130	59	24	100
35	90	36	180	..	..	...	..	..	...

EDISON BATTERY—NORMAL CHARGING RATES

Cell type...	B2-B4-B6	A4-G4	A5-G5	A6-G6	G7	A8	G9	A10	G11	A12	G14	G18
Normal charging rates.....	7.5 15 22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	105	135
Boosting rate.....	15 30 45	60	75	90	100	120	135	150	165	180	200	200

them to loose part of their active material, overheat, gas excessively, etc. The rates at which to charge both types of cells depend on the condition of the battery to a great extent, but the accompanying table may be applied with good results. It was furnished by the Automatic Electrical Devices Company.

INSPECTION OF MOTORS REDUCES REPAIR WORK

Large Plant, by Going Over All Motors Periodically and by Making Minor Adjustments, Has Been Able to Reduce Repair Work

The thorough inspection of each electric motor three times a week and blowing them out at least once a week has been responsible in a large measure for the small amount of motor repair work necessary in a war plant in Brooklyn, N. Y. In fact, it requires only one repair man working steadily to keep the motors in good shape, although there are more than 2000 hp. of connected motors in the plant.

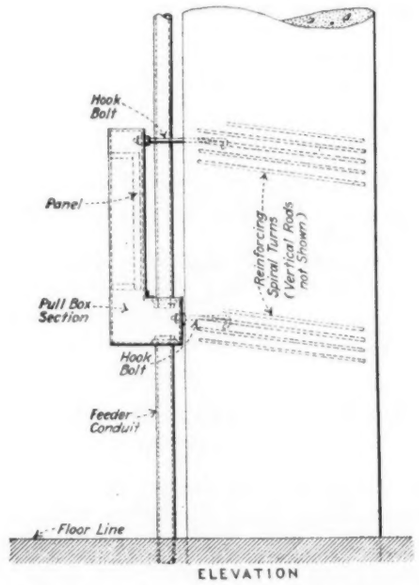
There are five maintenance electricians in the plant in addition to the chief, and to each one a certain section is given to inspect. He usually has time to oil these motors, replace brushes if necessary and sandpaper the commutators at least three times a week. In addition, one man is employed to go through the plant every night and blow out the motor windings with compressed air. For this work compressed air at 100 lb. pressure (7 kg. per sq.cm.) is available at valve openings throughout the plant. To these valves may be attached long rubber hose which will reach every motor.

New York City. L. HENRY.

MOTOR PANEL ATTACHED TO COLUMN REINFORCING

Holes Bored in Concrete and Bolts Hooked to Spiral Reinforcing in concrete Column Eliminate Use of Braces and Prevent Slipping

In some plants it has become the custom to attach motors or control apparatus directly to the concrete columns in order to conserve space. One very effective method of doing this has been developed by Meyer,



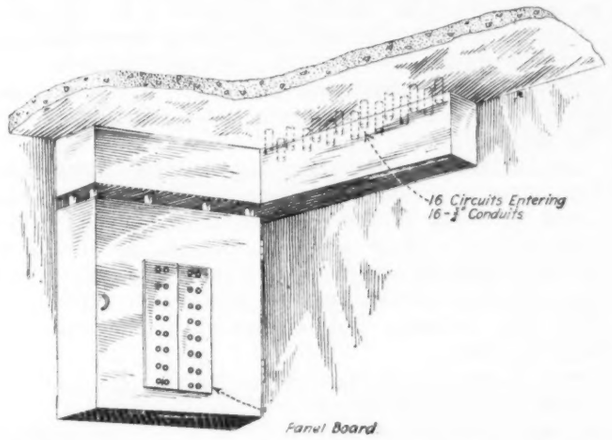
PANELBOX HOOKED TO COLUMN REINFORCING

Strong & Jones, Inc., engineers, which does not require special supports and which will not allow the attached apparatus to slip. Holes are bored in the concrete column and four hook bolts threaded on the straight end are inserted and hooked onto the spiral reinforcing steel. The hole is then filled up to give permanency and rigidness. Controlling apparatus can easily be changed without removing these hooks from the column thereby eliminating considerable trouble.

ALTERING CONSTRUCTION TO FIT BUILDING CHANGE

Sixteen Feeder Circuits in Conduits Terminating in Ceiling Had to Be Shifted When Wall Was Moved About 4 ft.

A change in the construction of a building after it is partly finished sometimes leads to difficulty in adapting the electrical construction, notwithstanding how small the change may be. The electrical design is especially affected when the feeder circuits are placed in conduit



CIRCUITS RUN DIRECTLY FROM CONDUITS TO PANELBOARD IN BOXES

embedded in the concrete walls and ceilings. In one case where conduit had been run up to the point where it was originally intended to install the panelboard it was necessary, almost at the last minute, to shift a wall 4 ft. (1.2 m.) and mount the panelboard in a different place. The conduits, of which there were sixteen of ¾ in. (18 mm.), ended flush with the ceiling, and it was not possible to attach additional conduit to them. To obviate open wiring, two metal boxes were constructed and placed against the ceiling so that a channel was formed from the conduits to a point above the new location of the panelboard. In this manner, which is clearly shown by the illustration, the circuits could be easily directed to their correct position with full protection against fire, etc.

CORRECT MOTOR SIZES OF GREAT IMPORTANCE

Owing to Motors Being 25 to 150 per Cent Too Large, Units Operated at Only 60 per Cent Power Factor and 79 per Cent Efficiency

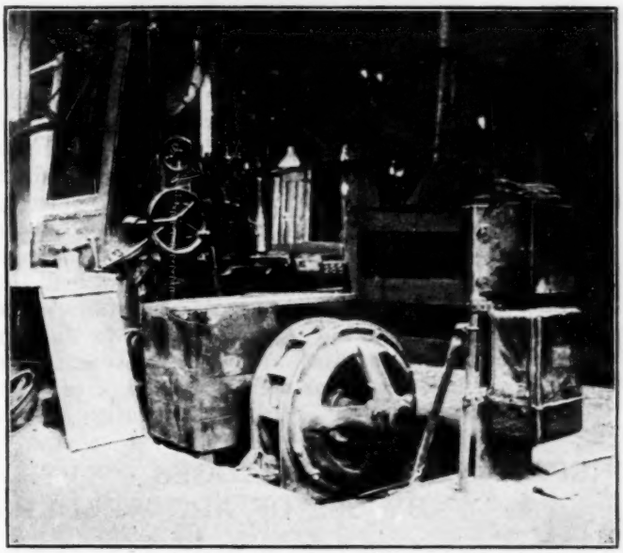
The increased cost of motors and of electrical energy directs attention to the importance of avoiding overpowering of machine tools, and investigations of shop conditions in this line are very much to the point at this time. In the last few years tool manufacturers and distributers of motors have accumulated much information as to the power requirements of different classes of service, and there is less excuse than ever before for the installation of motors of inordinate size. The war forced many temporary installations, but the time has now come when surveys of motor capacity in relation to duty are much wanted on a broader scale than heretofore has been the practice.

A single instance emphasizes the importance of this matter. In one large manufacturing plant it was found on an engineering survey of the motor ratings and loads that the induction motors were in most cases at least 25 per cent too large and in some instances 150 per cent larger than necessary. The average of the tests showed 37 per cent excess capacity in motors. There were nearly 1800 individual drives and about 1700 group drives in the plant. A card record is kept of motor applications, and test data are carefully filed. The power factor of the shops was 60 per cent. The motors were found to be working under average loads of about 30 per cent of their normal capacity, with an average motor efficiency of about 79 per cent. Had the motor loads averaged between half and full load, the efficiency would have increased to about 86 per cent and the power factor would have increased to 78 to 88 per cent. At the time of the tests very little had been done toward installing synchronous motors to improve the power factor. The opportunities in this direction and in the use of flywheels were apparently not recognized by the company to the extent which should have been the case.

BELT-DRIVEN MACHINE ADAPTED TO DIRECT DRIVE

Concrete Floor Is Recessed in Order to Allow Direct Drive from Motor Starter Placed So as Not to Interfere with Machine Operation

After deciding to convert all machines to individual drive, the Eclipse Box & Lumber Company of Greenpoint, Long Island, encountered some trouble in installing the machines, which were formerly belt-driven. In the case of the resaw shown herewith the shaft to be



WOODEN BOX PROTECTS CLUTCH MECHANISM BACK OF MOTOR

driven was so close to the floor that the motor had to be recessed in the floor to permit attaching it directly thereto. The motor switch and starter were placed at the opposite end of the motor from the resaw so that they would be out of the operator's way. Convenient control was provided, however, by placing a clutch between the motor and the resaw where the handle could be conveniently reached by the operator. A box covering the clutch mechanism prevents it from becoming

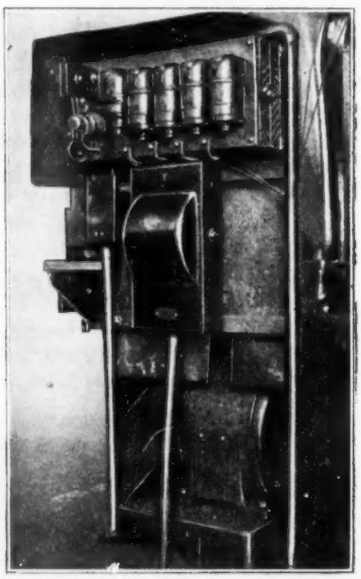
Greenpoint, L. I. W. O'FLATHERTY.

dirty and keeps most of the sawdust away from the motor. If the motor does become dirty it can be easily blown out, often by hand bellows.

CONTROL PANEL AFFORDING SAFETY AND RELIABILITY

Push-Button Starting Switch, Ironclad Service Switch and Shielded Relays and Contactors Protect Operators and Keep Out Dust and Oil Deposits

In equipping a machine in an Eastern industrial plant with motor-starting and protective apparatus, care had to be taken to afford the maximum protection to the



PUSH-BUTTON SWITCH, IRONCLAD SERVICE SWITCH RELAYS AND CONTACTORS MOUNTED ON PIPE FRAMEWORK

operators and at the same time assure reliable operation of the equipment. To do this a pipe framework was erected next to the machine, and on it were mounted an ironclad service switch and push-button starting switch. The contactors and relays were mounted above these pieces of equipment and protected from dust and oil by metal shields. These shields also prevent the operator getting his hands near exposed contacts as he might otherwise easily do if he attempted to start or stop the motor by reaching around the corner of the control board without looking. Lockwood, Greene & Company were the engineers in this installation.

REPAIRING GOLD DREDGES BY USE OF ARC WELDERS

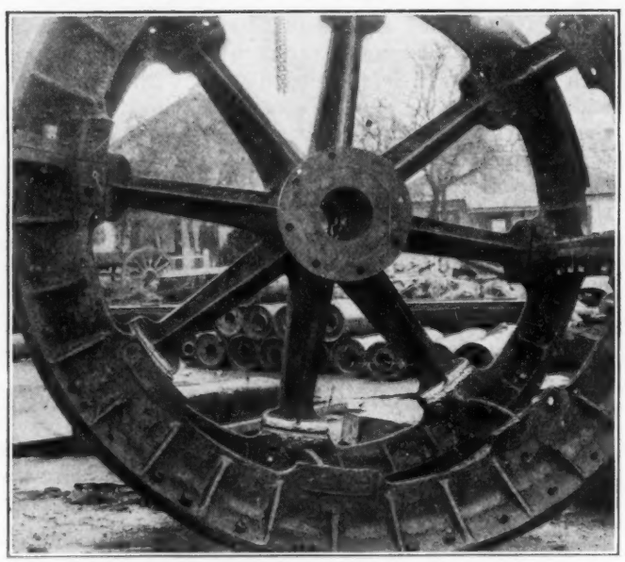
Used Principally for Building-up Work—About 6 Lb. to 6½ Lb. of Metal Deposited per Hour, with Energy Consumption About 3 Kw. hr. per Pound

Electric arc welding was adopted by the Yuba Consolidated Gold Fields, Hammonton, Cal., about a year ago to facilitate repair work on its dredges, save time and improve the quality of the work performed. Quick, durable repairs were particularly important because shut-downs are expensive and gold dredging imposes enormous stresses on the equipment. For this work a 400-amp., 60-volt General Electric arc-welding motor-generator set with control panels was selected and mounted in a weatherproof cabinet on I-beam supports so that it can be easily transported on trucks to any job. The set has been used principally for building-up work, but has also been utilized to reclaim any valuable parts relegated to the scrap heap.

Several times the value of the set has been saved since the outfit was put in service. For instance, it became desirable to operate an eight-hundred-dollar tumbler shaft 15 in. (40 cm.) in diameter in a larger bore than that for which the shaft was originally turned. Accordingly the arc was used to add the necessary section, after which the shaft was turned to the proper dimensions. Metallic electrodes ⅜ in. (9.5 mm.) in diameter were used with a current between 350 amp. and 400 amp. About 180 lb. (80 kg.) of metal was deposited at an average rate of 6.5 lb. (3 kg.) per hour. The energy consumption was 525 kw.-hr. and the complete cost of the job about $50.

At another time the strap keys holding together the two halves of a cast-steel screen roller ring were eliminated by filling in the recesses for the straps, which were 12 in. by 4 in. by 4 in. (30 cm. by 10 cm. by 10 cm.) with deposited metal. The rings had to support a weight of 50 tons to 60 tons in addition to their own weight. The importance of the weld thus becomes evident.

The surface to be welded beveled 45 deg. and acid treated or chipped before applying the metal and the surface carefully freed from oxidized material or foreign metal that would lower the quality of the weld by a wire brush. About 580 lb. (260 kg.) of metal were deposited, the average current being near 400 amp. and the electrodes the same as mentioned before. The total time required was 112 hours, although the actual welding time was only 100 hours. The energy



SPOKES OF BUCKET-LINE IDLER SPIDER WELDED TO RIM

consumption was 1721 kw.-hr. and the total cost of the job about $300.

To fasten a bucket-line idler spider to its rim (the two weighing 12 tons) the sections were clamped together with bolts and the joints beveled and welded together at a cost of $450 compared with $1200 if oxyacetylene welding had been used. Eight spokes had to be welded to the rim in this job.

San Francisco, Cal. H. G. NEWTON.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics. Including Applications of Electric Light, Power and Heat

HEALTH SUPERVISION FOR UTILITY EMPLOYEES

Development of an Important Activity in Organization of the Philadelphia Electric Company— Its Methods and Its Prospects

BY R. B. MATEER

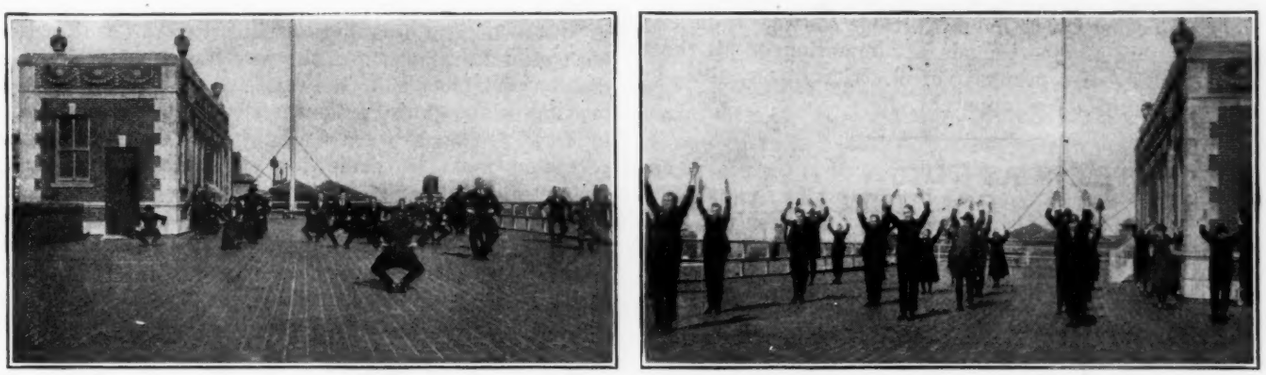
Seeking to get closer to the employee, to make a man like his work, to fit the right man into the right job, and to encourage thrift, certain utilities have promoted welfare work. Efforts have, however, been directed mainly to the working out of pension plans and insurance and profit-sharing projects, which, comprehensive as is their scope, seem more or less of a fleeting and visionary character, primarily because all quasi-benefits terminate when the ambitious employee, seeking recognition and advancement, identifies himself with other interests. It is therefore with the idea of giving to the staff of a public utility something of a permanent character that not only mental but also intensive physical development is encouraged, not as a part of welfare work, but as an important function of every central station's activities.

All things being equal, the athletically inclined man is the best man for industry, since he is healthier physically, mentally and morally, is more amenable to discipline, fairer in his opinions and dealings, more aggressive and better able to care for himself. Men of this type should and can be developed from the staff of present organizations, the more potent influences for such physical devolopment and mental poise being daily setting-up exercises, the week-end hike and the country club.

Casting aside inoculation as a preventive of disease and relying on natural physiological methods to develop bodily vigor and endurance, an aggressive public utility turned the tile roof of its new nine-story office building into a physical-welfare center for its staff. Word was passed along that each day at noon an instructor would meet such members of the general office force as desired to improve their physical condition. The plan has worked well, special exercises being employed to correct the most common physical defects.

Convinced of the sincerity of the "recruits" seeking health and bodily vigor, the "regulars" were requested to meet the physical director at a definite time on Saturday afternoons and then "hike" to points of local and historical interest. Details, of strength varying from twelve to one hundred, have enjoyed brisk jaunts through the open country, ending at the athletic association grounds, where golf, tennis and baseball supply amusement.

This athletic park is a tract of twenty-six acres in eastern Pennsylvania which the company has turned into a playground for its employees and their families. Club house, picnic grove, ball diamond, tennis courts, quoit courts, traps, a nine-hole golf course and gardens not only give pleasure but also build up self-reliance. The club is managed by an athletic association supported by a small monthly assessment on members. Attractive poster displays help to arrouse interest among the employees. Incidentally the company secures in this way much effective advertising.



BOTH MEN AND WOMEN EMPLOYEES TURN OUT DAILY FOR THE CALESTHENIC EXERCISES HELD ON THE ROOF OF THE PHILADELPHIA ELECTRIC COMPANY'S BUILDING

ELECTRICITY CHOSEN FOR CONSERVANCY WORK

Reasons Why Electric Motor-Driven Equipment Was Selected on Large Flood-Prevention Jobs in Ohio

Deciding what source of power should be used on the construction work of the Miami conservancy district near Dayton, Ohio was considered an important question. The work at widely separated points, would be heavy and would require energy in large quantities, totaling upward of 8000 hp. The applications of the power would be of great variety. There would be large

drag-line execavators and pumps for various purposes and of a great variety of sizes up to one taking several hundred horsepower. Power would also be required for gravel washers, concrete mixers, air compressors, wagon drills, shops, derricks and electric lighting. At the various camps there would be also a number of the smaller domestic uses for which power would be a convenience. Altogether more than twenty different applications could be counted where power would be necessary.

To provide for these various uses, the power evidently should be adaptable, reliable and economical. The sources considered were steam, gasoline and electricity, and a comparison of these was made before any equipment was purchased. Electric power was available in the Miami valley, where it can be brought to any of the construction centers. It is generated in large quantities, which makes it economical. Owing to the fact that the electrical transmission lines are fed from several generating stations, the power would be reliable. Moreover, most of the applications lending themselves to induction-motor application would require little skilled attention. There would be a considerable saving in coal. The elimination of trouble through the elimination of skilled attendance is also considered important, and the possibility of using electricity for light also caused it to have favorable consideration.

When the engineers made a summation of all these points the great superiority of electricity over steam or gasoline engines was apparent.

SUGGESTIONS AS TO COMMERCIAL POLICY

Conferences Highly Desirable in Meeting the New-Business Problems Now Arising and New England Companies Are Forehanded in Holding Them

A number of New England companies have taken the forehanded step of holding conferences on new-business matters and commercial policies. As stated in a recent issue of the ELECTRICAL WORLD, they are meeting under the auspices of the advertising and publicity committee of the New England Section of the National Electric Light Association. They are taking up various matters which present and approaching conditions bring acutely to the attention of the central-station manager. They evidently appreciate how necessary it is that commercial departments shall resume their active efforts to develop the business which economically belongs to the central station.

Many suggestions were made at the first conference of the New England companies, held at Augusta, Me., which are of general interest, and several of these are given below:

* * *

One of the keynotes of the meeting was the vital importance of maintaining steady sales of appliances and of getting away from campaigns. Year-round sales are the object and not flash-in-the-pan programs. Advertising should always be followed up by solicitation.

Campaigns are a form of bargaining, and electrical appliances are fast becoming staples. Sales effort should be "feeding up all the time with a steady push," which is far better than spurts followed by lapses. Regular sales tend toward regularity in purchases, in payment of bills, in settling installment accounts, and in a more economical administration of the sales department. It was advocated that the central station decide on some particular line of appliances to feature and carry others as a side line. It was suggested that where a customer has an iron of a certain make he be supplied with other equipment of the same make, so that in one case there will be a "Westinghouse" home, in another a "General Electric" home, and in another, for example, a "Western Electric" home or a "Universal" home.

* * *

The Boston Edison rate for electric range service is 10 cents per kilowatt-hour for the first 10 kw.-hr. per month, and 2 cents per kilowatt-hour for the excess, plus a war tax and coal differential which increase the foregoing about 25 per cent at present. People who have been discontinuing electric range service on the score of expense are now coming back to the company for service, chiefly because of its attractiveness.

* * *

The Central Maine Power Company, according to George M. Patterson, Waterville, has paid much attention to water heating by electrical energy and expects within thirty days to have a new heater ready rated in three sizes, 2400, 3600 and 4800 watts. The 3600-watt size is the most popular, and in earlier types used by this company sells for about $35. M. C. Osborn urged aiming to secure the lowest possible maximum demand in water-heating installations operated in conjunction with electric ranges. At the meeting considerable discussion took place as to the relative advantages of water heating on the quick versus the slow plan. It was stated by L. D. Gibbs, Edward Graham and others that some provision must be made for rapid heating of small quantities of water if the electric range is to attain its maximum possible usefulness. Mr. Gibbs advocated supplying an immersion heater with every electric range. Mr. Osborne strongly emphasized the value of continuous hot water secured by operating a tank heater from a double-throw switch; when the range proper is out of circuit the heater is in operation if the main switch is closed, and when the range is in use the heater is off. R. E. Holden, Portland, stated that he had found 1 kw.-hr. was required to heat 6 gal. of water to 170 deg. Fahr., and he installs a 3-kw. heater in connection with a 30-gal. kitchen tank.

* * *

Cooking for a local bakeshop has been demonstrated at the electric shop of the Narragansett Electric Lighting Company, Providence, R. I. The time schedule of various operations was advertised in the papers, and constant public interest aroused.

* * *

The general opinion was that supplying free energy to contractor-dealers for demonstrations and window or sign display lighting is so often abused that it is a mistaken policy. All should pay alike for the same character of electrical service.

* * *

The point was raised that continuity of central-station service is more important than regulation. It has been said that, when permitted, "our engineers use up our dividends in safety factors." A reasonable regulation suffices, especially in these days of utilizing appliances on interior lighting circuits. A low average rate for all-electric domestic service—say 1.6 cents, including range and water heating and lighting—is an antidote to domestic Bolshevism, it was claimed. The market for electrical appliances will never be saturated.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Mine-Type Motors.—L. C. MOSLEY.—The mine-type motor, in addition to being what its name implies, is particularly suitable for such steel-mill auxiliary drives as approach tables, straighteners, soaking-pit covers, etc. It represents the culmination of the combined endeavor of the mine operator, engineer and electrical manufacturer to produce the best motor for the purpose. The article outlines the unfavorable conditions under which it has to operate and describes the construction of the motor in detail.—*General Electric Review,* May 1919

Voltage Transformations with Auto-transformers.—E C. REED.—Fig. 1 shows the rating of the transformer parts which are required for a given transformation, as a percentage of the kva. transformed, for various voltage ratios ot transformation. It is apparent that the rating of the transformer parts increases rapidly with increasing ratios of transformation up to five, and for ratios greater than ten is practically constant. Since a two-winding transformer can be reconnected as an auto-transformer and give an increased rating, it is evident that, with the same rating, the auto-transformer could be built with less material. When the transformer windings are reconnected to form an auto-transformer with a greater output rating, the current densities, and consequently the losses remain the same, and since the output has increased the efficiency is increased. Since the percentage copper loss is less, the regulation at high

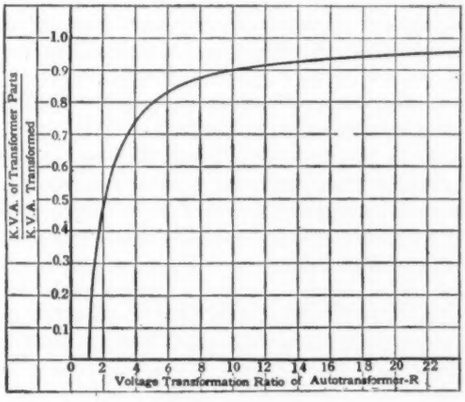


FIG. 1—EFFECT OF VOLTAGE RATIO ON THE RATING OF AN AUTO-TRANSFORMERS

power-factors is evidently improved. Three single-phase auto-transformers may be connected in star, as shown in Fig. 2, to secure a three-phase transformation. In the case of star connection the kva. of transformer capacity required depends on the ratio of voltage transformation and bears the same ratio to the kva. transformed as do the same quantities for a single auto-transformer performing a single-phase transformation. While a three-phase voltage transformation may be secured from the delta connection this arrangement is not practicable except for special cases, and for small ratios of voltage transformation, because of its inefficiency. Therefore with a voltage ratio of two to one as shown in the figure, the output would be only one-half of that for the star connection shown in the illustration with the same kva. transformer capacity.

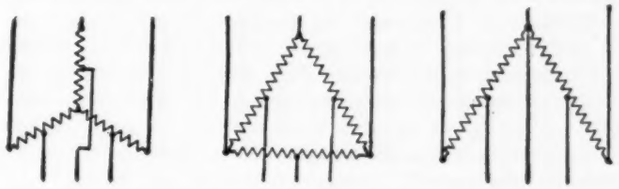


FIG. 2—THREE SINGLE-PHASE AUTO-TRANSFORMERS

The low voltage of a single-phase auto-transformer or of the star-connected group shown in the figure is in phase with the high voltage. But with the delta connection there is a phase rotation of the delivered voltage as compared to that impressed. This is a further objection to the delta connection, as parallel operation would not be possible with the star connection shown. Two single-phase auto-transformers may be connected in open delta so as to secure a three-phase transformation. The kva. of transformer capacity required for the transformation depends on the ratio of voltage transformation, and requires approximately 15 per cent more capacity than a single-phase auto-transformer, making the same voltage transformation single-phase. The additional capacity required is the same as that required by two single-phase transformers operating open delta. Aside from the question of capacity, the open delta connection has an advantage as compared to two T-connected auto-transformers in that the units are duplicates of each other.—*Electric Journal,* April, 1919.

The Emcol Motor.—In this motor an attempt is made to reduce the cost and size of totally inclosed machines by increasing the cooling surface or its effectiveness. As the internal surface offers nearly half the total resistance to the passage of heat from the interior to the exterior of a motor, it is evident that merely increasing the outer surface by ribbing or similar means is of small value unless the interior surface is also increased. The method by which the "Emcol" patent provides a greatly increased cooling surface, amounting in some cases to ten times the effective area as compared with the ordinarily totally inclosed motor, is applied to direct-current machines in this article. Tunnels or ducts are cast in the magnetic ring, and the internal hot air circulates throuhg the tunnels in a complete closed loop, passing through the motor and back through the tunnels in series. The motor is totally inclosed, as no air can pass from the outside to the inside of the motor. The

cooling air passing through the alternate tunnels into the yoke and out again does not enter the motor but merely cools the carcass. The cost of production of the "Emcol" motor is stated to be not more than 5 per cent above that incurred by producing the standard open-type machine, and the patentees expect that the majority of motors now classed as protected, drip-proof, rain-proof, etc., will in the future be built on the lines just described.—London *Electrician*, May 30, 1919.

Generation, Transmission and Distribution

Power Transmission.—H. B. VINCENT.—In this article may be found a rather complete discussion of operating methods with particular reference to the maintenance by means of pole-line maintenance data and other maintenance records.—Journal of the Engineers' Club of Philadelphia, June, 1919.

Power Installation at the Old Hickory Powder Plant.—Mechanical equipment of the power station at the largest smokeless powder plant in the world was erected in record-breaking time. The factors governing the design were speed of construction, low first cost, simplicity of operation and conservation of steel. This equipment includes sixty-eight 823-hp. boilers, fifty-two 350-hp. engines, 17,500-kw. in turbo-generators and thirteen ammonia compressors driven by uniflow engines.—*Power*, May 20, 1919.

New South Wales Power Station.—O. W. BRAIN.—The New South Wales Railway Commissioners' Metropolitan Electric Power Supply provides energy for the Sydney tramways, lighting and other services. The existing power house not lending itself to extension, a new power house was required to meet expected demands, which, including that for railway traction, may reach 100,000 kw. before long. Whether the power house should be at the mine or within the area supplied was decided by investigation, which showed that for 100,000 volts pressure and maximum load of 100,000 kw. transmission over 90 miles (145 km.) would cost 0.07d. per kilowatt delivered, while by carrying coal to a local power house the corresponding cost would be 0.04d. only, with other advantages. Producer-gas plant and gas engines were considered, but steam turbines were adopted. There will be provided ultimately eight steam raising units and ten generating units, of which two may be out of use. Each of the eight complete units may be used alone. Circulating water and coal supply arrangements are described. The boilers are of Babcock-Wilcox make, carrying 180-lb. per square inch (12.6 kg per sq.cm.). Furnace gases, after passing through Green economizers, go direct to chimney stacks of inverted-cone design, furnished with Pratt cold-air ejector draft. Arrangements for ash removal are indicated. The three turbo-alternators now installed furnish 25-cycle, three-phase current at 660 volts. Two are of Willians-Dick-Kerr make, and one is an American set, ordered because industrial troubles at home delayed delivery of the three British sets contracted for. Switch-house layout and details are described and particulars given of the general routine of operations. The working for May, 1918, shows: Output in kilowatt-hours, 4,982,828; maximum hourly load in kilowatt-hours, 15,800; load factor on one-hour basis, 42.3 per cent; pounds of coal per kilowatt-hour, 1.934; pounds of water per pound of coal (from and at 212 deg.), 9.67; efficiency of boilers, etc., 72.27 per cent.—*Technical Supplement to Review of Foreign Press*, May 13, 1919. (Abstracted from *Tramway and Railway World*, April 10, 1919.)

Hydroelectric Development of New Zealand.—The article is based on the report of E. Parry, chief electrical engineer to the Ministry of Public Works. It is recommended that in the interest of national economy and production the scheme should be planned in such manner and on such a scale that a supply of power would be available, with the coöperation of the local authorities, for every householder in the North Island and for any industry requiring the supply of power temporarily or otherwise, for main-line electrification, light railways, coal and other mines for winding, pumping, ventilating and smelting, and for any other purpose. In order to provide for the requirements outlined a total substation load of 130,000 hp. is necessary, requiring a plant capacity in the main power stations of 160,000 hp., allocated as follows: 96,000 hp. at Arapuni, 40,000 hp. at Waikaremoana and 24,000 hp. at Mangahao. The report deals exhaustively with the uses of electricity in New Zealand and the problems of generation and distribution utilizing to the best advantage the great hydroelectric facilities of that country.—*Electrical Times*, April 24, 1919.

Traction

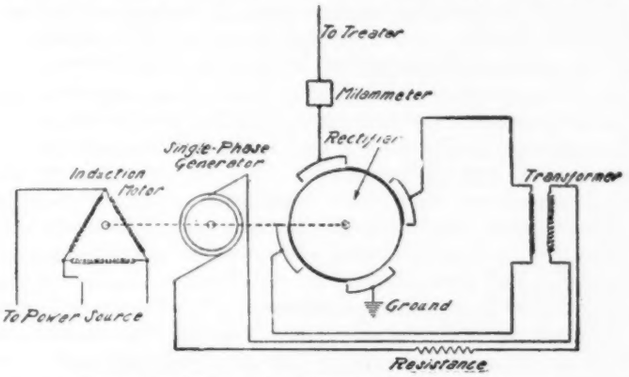
Methods Used in Third-Rail Bonding.—G. H. MCKELWAY.—It is said that high conductivity is the first essential for successful bonding, and ease of installation and maintenance are important considerations. Welded joints, soldered type of ribbon bond, protected bonds and bolted and soldered splice bars are discussed in particular.—*Electric Railway Journal*, June 14, 1919.

Spacing of Stopping Places in Tramways.—W. BETHGE.—The proper spacing of the stopping places in tramways is investigated from the points of view of the economy of running the service and the value of the time of the passengers, and a method is developed for finding the best spacing. It appears that the stopping places should be placed farther apart than before the war, on account of the altered conditions. A numerical example is given to illustrate the application of the method used. Previous investigations on this subject have been mainly confined to the problem of attaining the lowest running costs, and the value of the passengers' time has not been taken into account. In the special case worked out the saving by increasing the spacing of the stopping points from 300 m. to 740 m. is found to be 0.04 mark per car-kilometer in the operating cost and 0.05 mark per car-kilometer for the value of the passengers' time.—*Technical Supplement to Review of Foreign Press*, May 13, 1919. (Abstracted from *Elektrische Kraftbet. u. Bahnen*, Feb. 24 and March 4, 1919.)

Installations, Systems and Appliances

Electrical Precipitation of Solids from Flue Gases.—J. M. WAUCHOPE.—The Cotrell process is based on the principle that in a gas containing solids held in suspension the particles on being passed through a strong electrostatic field are electrified and deposited on the electrodes. This field must be produced by a direct current for the best results. Two electrical systems are described, one of which consists of an induction motor, driving a single-phase generator at 220 or 440 volts, a transformer and the rectifier. The generator supplies the step-up transformer from which high-ten-

sion energy is delivered to the rectifier to be changed into direct-current energy for use in the treater. The transformer is commonly a 100,000-volt transformer with taps giving several steps down to 50,000. The rectifier proper is of the common commutator type inserted in series on the high-tension side of the transformer as shown in the diagram. It is necessary to have a certain amount of resistance in the low-tension alternating-current circuit to act as ballast as steadying the operation, and in some cases very high resistance is used in the direct-current lead from the rectifier. Choke coils are usually mounted on the transformer terminals for its protection. An inductance may also be used in the direct-current circuit to good advantage. The milammeter shown in series between the rectifier and treater is a great aid in the proper operation of the set. The direct current will ordinarily average in



WIRING DIAGRAM FOR PRECIPITATION APPARATUS

the neighborhood of 50 to 300 or 400 milliamperes, this varying with gas conditions and the area of the surfaces in the treater being used. The voltage in common use runs from 20,000 to 75,000, and the direct-current voltage may be taken roughly as 80 per cent of the high-tension alternating-current voltage. In the treater, which is usually composed of vertical pipes with wires suspended in their centers, the gas is passed up through the pipes, thus being compelled to pass through the electrostatic field. The dust is deposited on the pipes principally although some collects on the wires. When the pipes and wires are shaken the dust falls into hoppers underneath from which it is taken away, and material of value is recovered from this dust. The writer also deals with common operating troubles and remedies of such sets.—*Electrical Review*, May 10,—1919.

Electrophysics and Magnetism

Aluminum and Its Lighter Alloys.—The physical properties of aluminum and its light alloys are described, and the effect of temperatures, different manufacturing operations and impurities upon these properties are discussed.—*Circular No. 76, Bureau of Standards*, April 21, 1919.

Construction of 120-Volt and 240-Volt Electromagnets and Solenoids.—HENRY W. TOWNSEND.—Data are given for the construction of a number of 120-volt and 240-volt electromagnets and solenoids. The theory of the design is not discussed, the data given being sufficient to show what may be expected of the magnet after it is built.—*Power*, June 10, 1919.

Characteristics of Electrical Operated Tuning Forks. H. M. DADOURIAN.—The author undertook to study conditions affecting the period of electrically operated tuning forks, investigating the effect of the mass of the supporting base, the length of gap between contact points, the influence of temperature, etc. Although each of these effects may be small, he has investigated them quantitatively.—*Physical Review*, May, 1919.

Units, Measurements and Instruments

Measurements of Conductivity of Insulating Materials at High Temperature.—F. B. SILSBEE and R. K. HONAMAN.—In this article methods of making the measurements are described and typical results given for fused silica, best porcelain, typical mica plug, average aviation porcelains and average automobile porcelain.—*Journal of the Washington Academy of Sciences*, May 4, 1919.

Theory of the Aron Meter.—H. G. ROWLEDGE.—The effect of an irregularly varying attraction on the frequency of a pendulum is considered. The author concludes that such errors as may arise by using a pendulum to measure an irregular attraction are compensatory and that in a large number of periods compensation by the law of averages tends to become exact, so that the time-integral of the attraction is correctly registered by the oscilliations of the pendulum.—London *Electrician*, May 30, 1919.

High-Tension Voltmeter.—A. IMHOF.—The author describes a type of high-tension voltmeter built by the firm of Trub, Tauber & Company of Hombrechtikon. This instrument is of the electrostatic type, with series condenser. The difficulties in making a meter of this type lie in the maintenance of very high insulation resistance and in the screening from external static effects. Illustrations are given of instruments for 4000 volts and 45,000 volts. Details of the construction are not given.—*Technical Supplement to Review of Foreign Press*, May 13, 1919. (Abstracted from the *Bulletin Schweizer, Elektrot, Verein, Bulletin*, March, 1919.)

Telegraphy, Telephony and Signals

The Telephone Systems of Large Cities.—E. A. LAIDLAW and W. H. GRINSTED.—The authors refer particularly to the case of the city of London. The authors consider (1) possibilities of improvement in quality of service, (2) adjustment of tariffs and (3) possibilities of reductions in expenses.—London *Electrician*, May 23, 1919.

Institute for Weak-Current Technology at Dresden.—H. BARKHUSEN.—An institute for weak-current technology (in distinction to heavy-current technology), with a professorial chair, has been formed in connection with the Dresden Polytechnik. The study of this branch of electrical engineering, which is concerned with methods of signaling, has not received the attention that it deserves. The curriculum will include telegraphy, telephony, wireless telegraphy and the theory of instruments, measurements and transmission lines.—*Technical Supplement to Review of oreign Press*, May 13, 1919. (Abstracted from *Elektrot, Zeits.*, Feb. 20, 1919.)

Miscellaneous

Johns Hopkins University.—J. B. WHITEHEAD.—A brief historical sketch of the development of Johns Hopkins University and a more detailed discussion of the mechanical and electrical courses and laboratories. —*Bulletin of Society for Promotion of Engineering Education*, May. 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

PLANS READY FOR MEETING OF CONTRACTORS-DEALERS

Arrangements Completed for Milwaukee Convention—Governor Phillips of Wisconsin Will Extend Welcome to the Delegates

W. H. Morton, general manager of the National Association of Electrical Contractors and Dealers, has announced the completed program for the nineteenth annual convention at Milwaukee, Wis., the week of July 14. Convention headquarters will be at the Hotel Pfister. Monday and Tuesday will be taken up by meetings of the Executive Committee, the general sessions beginning on Wednesday, July 16.

Paul C. Burril, chairman of the Wisconsin State Association, will open the convention. Gov. Emmanuel L. Phillips of Wisconsin will welcome the delegates in behalf of the State and W. C. Peet, chairman of the National Association, will respond. Frank B. White, secretary, National Agricultural Publishers' Association, will speak on "Coöperation in Business." At the afternoon session Frank Stockdale of Chicago will talk on "Keeping Up With Rising Costs," while representatives of the Estimators' Association of Chicago are slated to give a report, illustrated by lantern slides, on "Estimating Forms and Methods."

On Thursday the delegates will meet at Waukesha Beach where a business session will be held during the morning, the afternoon being devoted to sports. J. H. Moss, past-president, Milwaukee Association of Commerce, will speak on "General Business Conditions and Outlook," followed by W. L. Goodwin, whose topic will be "Merchandising Opportunities."

Friday morning will be devoted to section meetings. A. L. Swanson, Evansville, Ind., will preside over the first of these, where "Repair and Sale of Used Apparatus" will be the general topic. The following addresses will be made: "Methods of Determining Value of Burned-Out Apparatus," A. O. Kuehmsted, Gregory Electric Company; "What Constitutes Efficiency in the Repair Bureau," A. Penn Denton, Denton Engineering Company; "Methods of Dealing With the Public," speaker to be announced.

At the second section meeting, "Merchandising and Fixture Dealing," will be discussed and Joseph A. Fowler, Memphis, Tenn., will preside. The speakers and their subjects will be: "Arrangement and Conduct of a Retail Store," Phil Polacheck, Milwaukee; "Relation of the Dealer to the Public in Merchandising," J. R. Tomlinson, Portland, Ore. "Fixture Business is a Part of Retailing," A. L. Oppenheimer, Cleveland, Ohio. The Friday afternoon session will be spent in a general discussion of the labor problem as it affects the electrical contractor-dealer, based upon an address on "Human Relations in Industry," by H. L. Metcalf, Ph.D., who is connected with the Bureau of Industrial Research, New York City.

The entertainment will include a reception and dance at the Hotel Pfister on Wednesday evening and an informal dinner on Friday evening. Special entertainment features have been provided for the ladies.

GOVERNMENT OWNERSHIP IF COMMISSIONS FAIL

Samuel Insull Discusses Relations Between Utilities, the Public and the Commissions in Address Before Independent Telephone Association

"Whatever may be the difficulties of commission rule and regulation, it is infinitely to be preferred to the conditions under which the public utilities previously operated, and if commission rule should prove to be a failure we shall have municipal, state or federal government ownership of all the great utilities in this country." This is the only alternative in the judgment of Samuel Insull, who discussed these public-utility problems in an address before the fourth annual convention of the United States Independent Telephone Association at Chicago on June 25. He also said:

"Judged from the experience of the last two years the commissions seemed to realize that they were not created for the sole purpose of reducing rates. However, it does appear to be far more difficult for the commissions to increase the price for service than it was for them to make reductions when the tendency of commodity prices was in the opposite direction. The commissions, whether they like it or not, if they are true to their oaths of office—and a history of commission regulation shows that they are true to their oaths of office—must not hesitate to give redress to public utilities when their operating costs increase to a point where it is no longer good business for them to sell their product at the established rates.

"While being cross-examined before the Illinois State Commission last week, sometimes by the lawyer of the commission and sometimes by the lawyer for the city, the questions asked from time to time, and the conclusions drawn, made me think that one of the drawbacks of the commission form of regulation would probably be to check initiative, and to make the utility manager hesitate before he will branch out in some radically new departure either as to business methods or apparatus used."

The public utility managers have also to contend with the politicians, and on this subject Mr. Insull said: "The politicians must be made to understand that we people in the public utility business, our fellow employees and our fellow security holders, are just as much a portion of the people of the state or of the nation as any other class of people. There is no more reason why we should be deprived of our property without due process of law than there is that any other form of property should be sacrificed without proper regard for the law."

HIGHER RATES SOUGHT IN KANSAS CITY, MO.

Testimony Before Missouri Public Service Commission Shows that Company Borrowed $3,000,000 at 8 per Cent Interest but Had to Have Notes Indorsed

An increase of rates for energy, the removal of the discount feature and the substitution of a penalty feature, are being asked by the Kansas City Light & Power Company. The Public Service Commission of Missouri has held a series of hearings on the subject. The company now has rates of 8.8, 5.5 and 2.5 cents, the last named for cooking. The rates asked are 9, 7 and 5 cents. The substitution of a penalty feature for the surcharge was urged to gain economy in bookkeeping.

Incidentally, an increase of about 50 per cent is being asked in the rates for steam from the heating plant of the company. It was shown that the heating plant has been losing money, the lighting plant carrying the burden. J. B. Porter, president of the company, remarked that the heating plant lost $212,000 in 1917 and $244,000 in 1918.

Figures showed that the light company had paid a dividend of 2½ per cent in April, 1918. Since that time the electrical department had lost $156,000 and the heating department $244,000. Coal was responsible for $492,408 of increased costs, and labor for $160,000. Advances of $118,000 in material and supplies brought the total increased cost of operation to $750,000.

The company is asking that it be allowed to earn 6½ per cent on its investment. J. L. Harrop, engineer of the commission, testified that the "bare-bones" value of the property of the company in Missouri on Aug. 31, 1918, was $9,338,045. Mr. Harrop also said that he had not obtained details of the money spent for reorganization expense. This expense, said to be $587,384, the company is seeking to have added to the capital account.

During the hearing President Porter announced that a special arrangement had been necessary to get the money to build the new plant now under construction and that only through the indorsement of J. Ogden Armour had the money been secured. Through the Chase National Bank of New York, $3,000,000 had been borrowed, on which 8 per cent interest is being paid. Six and 7 per cent interest is being paid on other funds, secured also by the indorsement of Mr. Armour in Kansas City and Chicago.

SECTION OFFICERS OF THE ASSOCIATED MANUFACTURERS

Names of Officials of Various Sections of the Associated Manufacturers of Electrical Supplies, Elected at New London Meetings

During the meetings of the Associated Manufacturers of Electrical Supplies at New London, Conn., from June 16 to 18 officers were elected for a number of sections. The following have been reported to this time:

Knife Switch Section.—Officers re-elected as follows: J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company, Plainville, Conn.; T. A. McDowell, secretary, Westinghouse Electric & Manufacturing Company, East Pittsburgh; W. T. Pringle, treasurer of the Pringle Electric Manufacturing Company, Philadelphia.

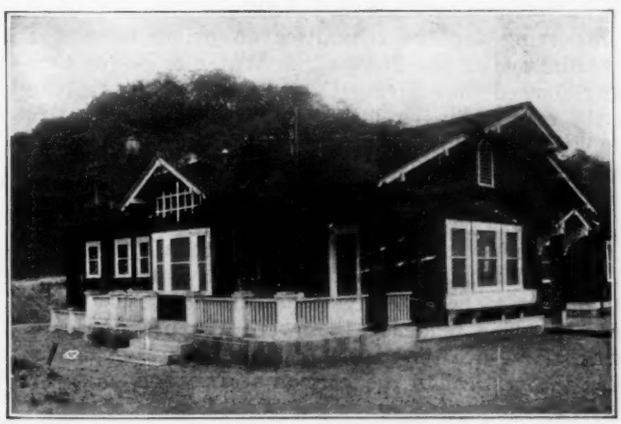
Lamp Receptacle and Socket Section.—Officers re-elected, as follows: H. R. Sargent, chairman, General Electric Company, Schenectady; H. J. Morey, secretary, Pass & Seymour, Inc., Solvay, N. Y.; G. E. Maguire, treasurer, E. H. Freeman Electric Company, Trenton.

Line Material Section.—L. McCarthy, chairman, The Macallen Company, Boston; A. L. Johnston, secretary, Electric Railway Equipment Company, Cincinnati; H. G. Lewis, treasurer, Electric Service Supplies Company, Philadelphia.

Outlet Box Section.—F. W. Hall, chairman (re-elected), Sprague Electric Works, New York; Geo. H. Sicard, secretary, Pratt-Chuck Company, Frankfort, N. Y.; H. D. Betts, treasurer, Thomas & Betts Company, New York.

Wire and Cable Section.—LeRoy Clark, chairman, Safety Insulated Wire & Cable Company, New York; M. H. Sigafoos, secretary, Hazard Manufacturing Company, Wilkes-Barre, Pa.; Edward Sawyer, treasurer, Atlantic Insulated Wire & Cable Company, New York.

Buildings for Employees at the Windsor Station



An employees' club house and homelike dwellings are furnished at the Windsor (W. Va.) plant of the American Gas & Electric Company and West Penn Power Company. They are attractive improvements.

ANNUAL MEETING OF CANADIAN ELECTRICAL ASSOCIATION

Committee Reports Epitomize Developments in Operating and Commercial Fields During the Past Year—Service at Cost Also Discussed

The 29th annual convention of the Canadian Electrical Association was held at Alexandria Bay, N. Y., June 27 and 28. The program in the main consisted of reports of the following committees: Accident prevention, prime movers, electrical apparatus, overhead lines, meters, rate research, commercial light and power sales and lighting sales bureau. In addition, papers were presented on Saturday morning one "Oxygen and Hydrogen A New Source of Revenue for the Central Station" by Farley G. Clark, chief engineer of the Toronto Power Company, and the other on "Service at Cost" by Ernest P. Fredericks of the Association of Holders of Public Utility Securities of Toronto. In view of the domination by the Hydro-Electric Power Commission of Ontario of the electric utility business in that province, it was suggested that it might be best to remove the association headquarters to Montreal, Quebec, but action on the suggestion will be held in abeyance for at least another year. With a few exceptions, the present staff of officers and managing committee were reëlected. Greetings of the National Electric Light Association with which the Canadian Electric Association is affiliated, were brought by S. A. Sewall, acting secretary of the National Electric Light Association.

ACCIDENT PREVENTION

Wills MacLachlan, chairman of the committee on accident prevention outlined the educational and publicity methods recommended by the National Electric Light Association's committee, and suggested their adoption by the Canadian association. Particular emphasis was placed on the new chart and booklet dealing with resuscitation from electric shock. These rules have been approved by the Hydro-Electric Power Commission of Ontario and by the Association of Municipal Electric Utilities of Ontario, and Mr. MacLachlan recommended their endorsement by the Canadian Electrical Association also. The committee called attention to the hazard of allowing men to use tools indiscriminately with insulated handles except for very high voltages, and recommended that dependence be placed upon rubber gloves, specifications for which formed part of the report.

PRIME MOVERS

Reporting for the committee on prime movers, S. Svenningson of the Shawinigan Water & Power Company showed that during the war one of the features in the manufacturing life of Canada was the plentiful supply of electrical energy made available through the development of waterpower resources. He showed that waterwheel efficiency of 92 to 93 per cent had already been obtained on the runners of several plants and that with a view to increasing the maximum over-all efficiency, hydraulic turbine engineers are now at work on the design of passageways from the head race to the tailrace. The tendency is toward the use of deeper draft tubes with the idea of making the water velocity from the vertical to the horizontal direction somewhat lower. Communications from manufacturers dealing with thrust bearings, governors and sizes of hydraulic units were included in the report.

On the steam generating end the present tendency toward higher steam pressures and concentration of power production in large units was noted. It was the opinion of the author that the quest for higher steam pressures is primarily a boiler problem, inasmuch as turbines can easily be designed for operation at the higher pressures.

APPARATUS AND METERS

J. F. Neild of the Toronto Electric Light Company, in reporting for the committee on electrical apparatus dwelt on the more practical operating conditions and the general trend of electrical practice. His report covered the points brought out in the report of the electrical apparatus committee at the convention of the National Electric Light Association at Atlantic City, the committee having worked in close touch with the sub-committees of the latter association.

The committee on meters of which E. J. Turley of the Montreal Light Heat & Power Consolidated, was chairman, discussed the present commercial methods of recalibrating meters and their inspection by the Dominion government. He suggested that the association make an effort to have the Dominion government improve its present system of meter inspection and that a committee on standardization at present being organized in Ottawa be petitioned to take up the standardization of watthour meters with a view to having all dials, connections, etc., standard throughout the Dominion.

COMMERCIAL DEVELOPMENT

In his report on commercial light and power sales, R. J. Beaumont of the Shawinigan Water & Power Company contrasted the immense developments in the industrial lighting field with those in the residence, store and street lighting fields where because of war conditions the growth was greatly retarded. The signing of the armistice did not bring with it the great decline in power load estimated, and the immediate future in Canada holds a promise for sales of considerable amounts in electrical energy in smaller blocks, but covering a wider range of products. To meet this demand, many of the large companies in Canada are either constructing plants or preparing designs.

In the opinion of the committee if some means could be found whereby the cost to consumers of the electric stove could be reduced, the electric range load could be greatly increased in Canada where very low rates for energy for heating purposes are in effect. There is room for what might be termed the "Ford of the Electric Range Business," and if a range could be sold at $60, the range load would be greatly stimulated. The wider use of synchronous motors in Canada was touched on and the committee recommended that electrical manufacturers give attention to the subject with the idea of standardizing the design and reducing the cost of the motors.

SERVICE AT COST

The importance and necessity of readjusting public utilities on a basis acceptable to the public and at the same time stabilizing the securities representing investment in these utilities was discussed by Ernest P. Fredericks who offered a plan to overcome the difficulty facing utilities because of increasing expenses and decreasing receipts. This plan is known as Service at

Cost. Briefly summarized this plan possesses the following features: It calls for close public supervision; it demands an improvement in service and the maintenance of service at its best standard; it demands efficient and honest administration; it provides for charges sufficient only to pay the actual cost of good actual service; it guarantees the integrity of the investment; and it restores the credit of the utilities effected and renews public confidence in them. This plan has already been placed in effect by a number of electric railway companies in the United States and Canada and according to the author has worked out to the satisfaction of both the general public and the operating companies.

OFFICERS ELECTED

At the executive session held on Saturday afternoon, the following officers were elected: A. Monro Grier, Canadian Niagara Power Company, Niagara Falls, Ont., president; E. A. Dunlop, Pembroke Electric Light Company, Pembroke, Ont., first vice president; P. T. Davies, Southern Canada Power Company, Montreal, second vice president; A. P. Doddridge, Quebec Railway, Light, Heat & Power Company, Quebec City, third vice president; T. S. Young, Toronto, honorary secretary; and William Volkmann, Toronto Power Company, secretary-treasurer. Managing committee, R. J. Beaumont, Montreal; A. M. Gale, Hull, Que.; C. S. Bagg, Montreal; J. S. Gould, Merrickville, Ont.; D. H. McDougall, Toronto; R. B. McDunnough, Quebec; W. H. McIntyre, Ottawa; J. F. Neild, Toronto; J. S. Norris, Montreal; L. W. Pratt, Hamilton, Ont.; G. B. Woodyatt, Montreal; H. R. Millison, Halifax; F. T. Kaelin, Montreal; A. A. Dion, Ottawa; and the president of the National Electric Light Association.

CONTINUED HIGH LEVEL OF COMMODITY PRICES

Opinions Given to the Department of Labor Point to Expectation That General Range of Prices Will Remain High

Opinions given to the Department of Labor and made public by Roger W. Babson indicate the probability of continued high prices of commodities. Among the statements are the following:

MAJOR-GEN. GEORGE W. GOETHALS.—Every thoughtful employer of labor realizes that the wage earner is entitled to proportionately more of the comforts and conveniences of life than fell to his share before the war. Every thoughtful buyer should realize that the price he pays for goods must be in proportion to the increased cost of labor. Also that labor, in the broadest sense, constitutes over 75 per cent of the cost of most products of farm, forest, mine, factory and laboratory. The manufacturer, employer or individual who is selling his own labor, brains or product at a high though reasonable price should not expect to buy cheaply from others. Let us be careful, in our cry for lower prices, not to forget that permanent improvement of living conditions is effected only by increased efficiency of the forces of production; and experience shows such increase of efficiency is at best a slow process—a process of years and perhaps decades.

THEODORE N. VAIL, Chairman American Telephone & Telegraph Company.—The principal causes of the gradual return to pre-war price levels has been ascribed to the rapid transformation of manufacturing, agriculture, mining, transportation and business in general from hand methods to machine methods, from small-scale to large-scale production. Opportunities do not exist at the present day in any measure comparable with those of the period following the civil war. Price declines so far, since the cessation of hostilities, bear this out, having been trifling—only 5 or 6 per cent up to April 1, 1919, as compared with over 25 per cent for the corresponding period of the Civil War. Abstract consideration of these facts does not support any expectation that there will be sudden and radical declines in present prices.

JOHN D. RYAN, president Montana Power Company and Anaconda Copper Company.—I am rather a firm believer in the natural economic laws, and I do not find myself in accord with the impression that many people seem to have that the level of prices is not likely to be radically changed over the decade. I believe that prices must be made that will equalize consumption and production. We have seen some sharp adjustments already from war prices, and in every product in which the companies with which I am connected are interested prices have gone back to pre-war averages, and in some cases lower. These products are copper, zinc, lead and manganese. I do not believe that the level of prices will fall permanently as low as before the war, but I am convinced that we can now look for gradual adjustments in most staple products. I think prices will have to be put where buildings and development of all kinds must be encouraged before we will see consumption approach production in the staples. I think in the adjustments which are necessary labor will have to contribute its share, or unemployment on a very serious scale is bound to result.

WATER POWER LEGISLATION IS POSTPONED ONCE MORE

Under Debate Twice But Lost Through Appropriation Conferences and Now Is to Be Set Aside for Treaty of Peace Discussion

The water power bill presented to the House of Repesentatives by Representative Esch of Wisconsin, chairman of the joint waterpower committee of the House, has been under debate upon two occasions recently. It was debated in the House on Monday, June 30, and also on Friday, June 27. The Washington representative of the ELECTRICAL WORLD reports that the bill has become entangled in a series of conference reports in the House upon the District of Columbia appropriation bill and other measures which are of privileged character and which shoved the water-power bill off the calendar for the time being.

At this writing the House of Representatives and Senate intend to take a recess over the Fourth of July holidays which will probably continue until after President Wilson has returned to this country. Upon his return it is expected that in view of the fact that the appropriation bills have been gotten out of the way the House and the Senate will devote most of their attention and energy to matters of foreign policy particularly related to the treaty of peace with Germany and the proposal for the establishment of a League of Nations. Only the most optimistic friends of the water-power legislation now expect its early passage.

Operating Ratio Under War Costs

The operating ratio of one large company at a normal period before the war, excluding taxes, was 50 per cent; with taxes it was 52 per cent. In April, 1918, it was, without taxes, 70 per cent, and with taxes it was 78 per cent. At present the figures stand 61 per cent without taxes and 66 per cent with taxes.

HOPE FOR THE PUBLIC UTILITY SITUATION

Stone & Webster Call Attention to the Fact that Local Utilities "Carried On" During the War Without Guarantee or Other Government Aid

It is the belief of Stone & Webster that there is a solid basis for optimism in the public utility situation, despite the difficulties of the war period and that at present prices, with conditions improving, the opportunity is open for profitable investment in many securities of established companies. They have issued a circular on "The Public Utility Situation" in which they speak hopefully of conditions. They discuss the three classes of utilities—electric, gas and electric railway. The following extracts from the circular relate more particularly to the general conditions and those touching electric utilities:

President Wilson, in his recent message to Congress, has called the attention of the country to the need of constructive action in regard to public utilities. Acting upon the joint recommendation of the Secretaries of Commerce and of Labor, the appointment of the Federal Electric Railways Commission was announced on June 5th. The question, therefore, of restoring public utility credit has become definitely recognized as one of the the most important domestic matters to be solved during the coming period of readjustment

This credit must be reëstablished on a basis that will insure to this great industry, representing an investment of rising twelve billions of dollars, not only an adequate return on the capital already invested but also sufficient safeguards for the new capital that must continually be attracted so that utilities may serve in the growth of the nation. One must lose faith in our institutions and in the common sense of the American people to believe that necessary readjustments in rates for service will not continue until capital is again forthcoming for investment.

The service rendered in supplying light, power, gas and transportation in our cities and for our manufactories is as fundamental to the industrial and economic life of this country as are our railroads, our mines, our oil fields, our agricultural lands and our factories. . . . More than 60 per cent of the industrial factory power of the country is furnished by light and power companies and the proportion of our total population of about 107,000,000 not touched by either electric light or gas is very small indeed. The savings invested in this branch of industry as reflected in public service securities held by savings banks and societies, by trust companies, life insurance companies, endowment funds of educational institutions, hospitals and churches, as well as by thousands of individual investors, both rich and poor, are a considerable part of all the savings invested in the permanent structures of the country, devoted to the great community needs.

Yet, this great group of public service companies, serving national needs, shouldering all the higher costs of labor, taxes, materials and supplies occasioned by the war, received practically no financial aid from Governmental sources and no assistance in a comprehensive plan for effective and speedy relief in the way of securing higher rates and fares—except as could be worked out by each individual company through the slow method of application to the State Commissions, municipal authorities and referendum vote. This great industry was obliged to "carry on," and the record achieved instead of deserving the more or less popular comment, "What is the matter with public utility credit?" is more worthy of the question, "Why is it in such comparatively good shape as it is?" The fact is, that public utilities did "carry on." In spite of the difficulties of operation they took up the war burden with no guarantee such as that which went to the farmer for the price of wheat, and with no fixing of minimum prices for their product such as was placed on other basic commodities in order to encourage production, and with no guarantee from the Government such as was established in the control of the railroads, telephones and telegraphs.

Capital had to be secured to take care of maturing obligations, amounting in 1918 to over $225,000,000, at interest rates in many instances much higher than the fixed rate of return allowed on the investment by franchises and other regulations, and with the temporary sacrifice in many cases of a large part of the equity value. In normal years the amount of new money required annually by public utilities for extensions to plant aggregates from $600,000,000 to $700,000,000. During the period of the war these requirements were cut to approximately $250,000,000 per annum, but this money had to be raised in addition to the maturing obligations. In not a few cases new plant was supplied and financed for war requirements which may prove unnecessary when peace conditions are completely restored. No broad provisions were made to enable public utilities to write off expenditures of this kind to "war loss," yet we read that in the operation of the railroads the Government to-day is spending over 90 cents out of every dollar taken in and the cost to the taxpayer is already reflected in the appropriation applied for at this session of Congress by the Director General of the railroads amounting to $1,200,000,000.

The capital invested in utilities is in substantial and durable structures which cannot be reproduced except at costs greatly in excess of the original investment. The services the companies render have become necessities and so will continue to be desired and must be paid for at a price required to secure them. The properties are growing and betterments and extensions must be provided.

BOSTON EDISON RATE HEARINGS CONTINUED

Commission Rules That Part of Records of Customers Will Be Sufficient For Company to Furnish in Case

Hearings on the merits of the case in the Boston Edison rate proceedings before the Massachusetts Gas and Electric Light Commission will be resumed on Sept. 22. At a continued hearing on June 30 a protracted discussion occurred regarding the furnishing of additional information by the company to the petitioners for rate reductions. The company has answered nearly eighty interrogatories in the preliminary proceedings of the case, all of which were presented in writing and submitted for the consideration of the commission in conferences with the parties.

At the last hearing it was pointed out by F. M. Ives, counsel for the company, that to answer certain inquiries regarding the energy consumption and rates of individual customers it would be necessary to examine and tabulate the data upon 156,000 separate bills. Chairman Weed informed Maurice Palais, counsel for G. S. MacFarland, of the Hearst interests, petitioners, that the board desired to avoid selecting inquiries for the petitioners, who are responsible for their own questions addressed to the company. The commission will not ask the company to prepare answers to questions requiring the employment of extra clerical assistance at this time.

The commission ruled that instead of submitting the names of customers in large numbers billed under the different rate schedules, it would suffice if the company supplied the names of the ten highest and the ten lowest customers from each rate classification, measured in terms of money paid. Such a "cross-section," the commission believed, would afford ample ground for studying the working out of the rates. Various substation load curves were also promised by the company in response to the petitioners' requests.

The Housewife's Creditors

AND ELECTRICITY PRESENTS THE SMALLEST BILL

From the Daily published by the ELECTRICAL WORLD at the Atlantic City Convention of the N. E. L. A.

ILLINOIS LEGISLATURE KILLS HOME RULE UTILITY BILLS

Effort of Municipalities and Others to Rob State Utility Commission of Authority Fails—Legislature Leaves Law Unchanged

The proposed home rule legislation which aimed to give cities in the state control over their utilities was killed in both the Senate and the House of Representatives of the State of Illinois.

The senate committee on public utilities laid the proposed bill on the table by a vote of thirteen to nine and reported out a bill by the committee increasing the membership of the commission to seven members. The house committee on public utilities reported out home rule bill No. 290 and bills Nos. 154 and 160, validating franchise ordinances, with the recommendation that none of them be passed. This recommendation of its public utility committee was approved by the House by a vote of eighty-four to fifty-three.

Since taking this action the Legislature has adjourned, which stops, for the time being at any rate, the possibility of there being any change in the present public utilities laws affecting the jurisdiction of the commission.

CO-ORDINATING ELECTRICAL PUBLICITY ON OUTLETS

Movement Gains Headway to Show Wall and Floor Receptacles in All Socket-Appliance Advertising with Devices Ready for Use

The Commercial Section of the National Electric Light Association has begun an active campaign to show all advertisers of electrical goods the value of popularizing floor and wall receptables. As a practical method of working out this idea all manufacturers of socket appliances are being asked to see that all their illustrated advertising to the trade and to the general public depicts their product directly connected to a wall or floor receptable. Present practice in illustrating many of these is to show the cord either cut off or coiled up with the plug lying unconnected. By calling attention to this fact the section hopes to get manufacturers to see the value of having receptacles included in all their drawings.

The reasons for this activity by the Commercial Section are thought to be so far-reaching that no one will combat the idea once it has been explained. In pointing out some of the advantages of the plan John G. Learned, chairman of the Commercial Section, said:

"The popularization of extra outlets benefits every branch of the industry. Manufacturers of receptables, plugs, switches, wire, conduit and all wiring supplies will benefit by direct sales. Manufacturers of appliances will benefit by effecting the removal of one of the obstacles to appliance sales, namely, inadequate outlet facilities. Contractor-dealers will secure more work.

Central stations will gain to the extent of the additional revenue which an additional outlet brings. And the public will gain in convenience and service."

Those electrical manufacturers who have already been approached on this subject have visualized its possibilities and are already taking steps to get their advertising changed to incorporate this outlet idea.

COST OF EXTENSIONS FOR POWER SERVICE

California Commission Decides Conditions on Which Sierra & San Francisco Power Company May Require Consumers to Advance Cost of $75 or More

As a result of an investigation made on its own iniatiative, the California Railroad Commission ordered the Sierra & San Francisco Power Company to refund to applicants for power service moneys deposited with the company to secure extensions where the cost of the extension did not exceed $75. The order affects only deposits made after Nov. 1, 1918.

The company had been enforcing a rule requiring applicants for service to deposit with the company the cost of all extensions requiring the expenditure of $50 or more. Hereafter the company must use its own funds to provide extensions costing up to $75, but may require consumers to advance larger amounts. Seven per cent interest on these advances must be paid by the company, and they must be refunded in accordance with terms dictated by the commission. Other orders issued by the commission as a result of the investigation of the company's methods are as follows:

Where the cost of any extension for service exceeds $75 per consumer, the company may require that the consumer deposit with the company the entire cost of the extension and will, upon receipt of such deposit, take steps to make the extension without delay.

Where deposits are made by applicants for service and the annual revenue from the extension shall equal or exceed 25 per cent of the cost of the extension, the company will pay interest at the rate of 7 per cent per annum from date of deposit upon the amount on deposit and not refunded, not to exceed three times the annual revenue. The amount advanced will be refunded one-third at the end of twelve months from the date service is rendered, one-third at the end of twenty-four months and one-third at the end of three years.

In case of extensions, where tne revenue is less than 25 per cent of the cost of extension, the consumer may obtain service under this rule by either guaranteeing 25 per cent revenue or constructing and maintaining that portion of the extension in excess of four times the annual revenue.

The order is the result of a public hearing. Complaints of company practice had been received. However the evidence offered at the hearing supported this contention to such an extent that the commission, in making its order in the case, says:

In October, 1918, the company was authorized to increase its rates. It appears that the resultant net earnings are not materially in excess of the requirements for depreciation and bond interest due to the increased operating expenses. It therefore appears that no material amount for extensions could be obtained from earnings.

From July 1, 1918, to March 21, 1919, the company expended $153,000 in betterments and additions to its system. Of this amount $61,000 was expended for distribution extensions in the San Joaquin district. The company's hydroelectric plants are operating to full capacity, and it is necessary within the next two years that considerable development, costing in excess of $1,000,000, be made in order to supply additional requirements for power. From consideration of this it is apparent that if the company expects to continue as an active growing utility it must obtain from outside sources additional moneys in relatively large amounts to produce the power required by the districts it serves and meet the reasonable demands for extensions of service on its system. In addition, large amounts must be expended to improve service conditions.

Under normal conditions the company should make all reasonable extensions at its own cost and not require assistance from the consumers.

TRADE COMBINATIONS IN GREAT BRITAIN

Committee on Trusts, Reporting to Minister of Reconstruction, Finds an Increasing Tendency Toward the Formation of Combinations

In recommending investigation of the operations of trade associations and combinations in Great Britain, the report of the committee on trusts takes up various industries specifically. After mentioning the situation in several industries it speaks of the electrical industry. It declares that in the electrical industry alone there is an "association of businesses of a different nature" with a capital of £33,000,000. The committee, appointed by the Minister of Reconstruction in February, 1918, finds that in every branch of industry there is an increasing tendency toward the formation of combinations.

Several different classes of industrial combinations in various industries are listed by the committee. While some associations simply fix the price to be charged, others have regulations with regard to tenders for contracts. Others eliminate outside competition by imposing restrictive conditions on purchasers, and still others regulate output by allotting to each member a fixed percentage of the total production, with fines for exceeding this limit and compensation for falling short, the fines being paid into a pool and the compensations drawn from it. One result of such an arrangement, the committee finds, is that a member may withdraw from active manufacture, allowing his share of the output to be absorbed by other firms, and still draw a substantial sum from the pool.

THE WORLD'S LARGEST ELECTRIC GENERATORS

Two Units Now Under Construction for Hydro-Electric Power Commission of Ontario Have Nominal Rating of 45,000 Kva. Each

There is at the present time under construction by the Westinghouse Electric & Manufacturing Company of Pittsburgh and the Canadian Westinghouse Company of Hamilton, Ont., two waterwheel-type electric generators which are the largest of their kind thus far ever built. The units are nominally rated at 45,000 kva., 12,000 volts, three-phase, 25 cycles, 187 r.p.m., with a maximum continuous rating of 50,000 kva. The machines are of the vertical-shaft type, equipped with two guide bearings and a Kingsbury thrust bearings which carries the combined load of the grenerator and turbine rotating parts and the unbalanced water thrust amounting, roughly, to a million pounds (450,000 kg.). The thrust bearing is carried by a supporting bracket which is mounted above the generator frame and carried by it.

Although the generator is designed to operate at relatively low temperatures, both field and armature coils are insulated throughout with asbestos and mica insulating materials guaranteed for a total operating temperature of 150 deg. C.

These two units are the first of a number proposed for installation at the Queenstown Development of the Hydro-Electric Power Commission of Ontario. Possibly, a better mental picture can be obtained of the large output of such a machine if it is remembered that they would each, neglecting transmission, furnish power to light half a million 100-watt lamps, which would, if spaced approximately 250 ft. (75 m.) illuminate a street extending entirely around the earth at its maximum diameter.

STUDY OF ENGINEERING IS IMPORTANT FOR THE NAVY

Secretary Daniels, in Reopening Post-Graduate School at Annapolis, Speaks With High Praise of Electric Ship Propulsion

Secretary of the Navy Josephus Daniels made an address on June 12 at the opening exercises of the Post-Graduate School at the Naval Academy, Annapolis, Md., in which he emphasized the great importance of special duty by officers of the navy in the science of engineering.

The post-graduate course was established a few years ago for officers of the navy who desired to become experts in features of design of the various types of engines and machinery used in the fighting ships. These include not only steam machines but also electrical machinery, gas engines and guns and their accessories. The post-graduate school was suspended during the period of the war and its regular work is just being resumed.

Secretary Daniels showed the great importance of engineering in its many branches in the navy. He indicated the value of knowledge in all branches. "The great commander is greater if he has been trained in all," said Mr. Daniels, "for knowledge of engineer and ordnance duties is essential to the highest when in command in modern machine warfare."

The Secretary also paid a tribute to those who have developed electric ship propulsion for the navy. Going into detail on this point he said:

In considering the broad field of engineering and the accomplishments of the navy in this science it is inspiring to know that one of the greatest achievements of our navy during the past half century is the adaption of electric propeelling machinery for our huge battleships. Too much praise for this advance cannot be given to Rear Admiral R. S. Griffin, chief of the Bureau of Steam Engineering, to W. L. Emmet, of the General Electric Company, and to the other engineers in civil life who have joined our naval officers in bringing this unique and far-reaching accomplishment to a successful issue.

The suitability of the electric drive for naval vessels was under discussion by our experts for several years. It was first tried out on the collier Jupiter, where it met every test as to economy, facility of operation and endurance. As a result of the very satisfactory service of the Jupiter, it was decided to adopt this type of machinery for the battleship New Mexico, and her successful operation has given great gratification to everyone concerned since these results are a notable monument to American progress in the field of engineering.

The adoption of the electric drive is also a notable indication of the knowledge of engineering science which now exists generally among the officers of the navy and is as well a tribute to the high training and marked skill of the civilian engineers and naval experts who brought this epoch-making design to a successful finish.

In all this we have but won another in the long list of triumphs which have given American engineers so high a place among the world's leaders in invention and mechanical progress—those pioneers whose work, in applying nature's resources to the use of man, has been of such inestimable service to our race.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Panama Section—On June 1 William T. O'Connell and M. P. Benninger, both of Balboa Heights, were elected chairman and secretary-treasurer, respectively, of this section of the American Insitute of Electrical Engineers, which now has a membership of 104.

N. E. L. A., New England Section Convention.—The dates for the convention of the New England Section, National Electric Light Association, at Hotel Griswold, New London, Conn., were erroneously announced in the ELECTRICAL WORLD for June 21. The correct dates are Sept. 22 to 24.

N. E. L. A., Portland (Ore.) Section.—The Portland (Ore.) section of the National Electric Light Association has elected these officers for the ensuing year: F. H. Murphy, Portland Railway, Light and Power Company, chairman, and George Bowen, sales manager, Northwestern Electric Company, secretary.

Navy Organization Joins American Association of Engineers.—The Navy Technical Association, consisting of 700 civilian engineers in the navy yards at Boston, Newport, Hartford, New York, Schenectady, Philadelphia, Washington, Norfolk and Hampton Roads, has been amalgamated with the American Association of Engineers.

Illinois Association of Electrical Contractors and Dealers.—At a meeting of the association at Decatur, Ill., June 20 and 21, the principal subject of discussion was ways and means for increasing the strength of the association by making it more nearly representative of the electrical contractors of the state. Plans were laid to make the association membership profitable to even the smallest contractor, and to make every member a merchant. W. H. Morton, national secretary of the organization, was in attendance, as were also Tom J. Casey, of the Hurley Machine Company, Oliver Hogue, Commonwealth Edison Company, and G. C. Breidert, of the Ilg Electric Ventilating Company, Chicago. Each of these visitors delivered an address.

St. Louis Electrical Board of Trade.—The following officers and directors were elected for the ensuing year on June 23: President, J. S. Tritle, district manager, Westinghouse Electric & Manufacturing Company; first vice-president, C. E. Michel, sales manager, Union Electric & Power Company; second vice-president, H. N. Goodell, district manager, Western Electric Company; treasurer, Fred B. Adam, president, Frank Adam Electric Company; directors, Frederic A. Kehl, president Brilliant Sign Company; B. H. Mann, Missouri Pacific Railway Company; H. H. Humphrey, consulting engineer; A. S. Langsdorf, dean of engineering, Washington University, and F. O. Hale, general manager, Southwestern Bell Telephone Company. This is the first election of officers since the Board of Trade was organized this spring.

N. E. L. A., Michigan Section.—The Michigan Section of the National Electric Light Association has decided to hold its annual convention at Hotel Ottawa, Ottawa Beach, Mich., from Aug. 19 to 21. Herbert Silvester, Monroe, Mich, is secretary-treasurer of the association.

A. I. E. E., Detroit—Ann Arbor Section.—At the annual meeting of the Detroit-Ann Arbor section, American Institute of Electrical Engineers, held on June 20, the election of officers resulted as follows: Chairman, Prof. J. C. Parker, University of Michigan, Ann Arbor, Mich.; secretary-treasurer, C. E. Wise, 424 Ford Building, Detroit, Mich.

O. E. L. A. Convention.—The tentative program of the Ohio Electric Light Association's Convention which is to take place at Cedar Point, Ohio, from July 15 to 18, includes these addresses and papers: "Daily Unit Data and Cost Systems," by J. M. Strike, Acme Power Company, Toledo; address by William McClellan, vice president, Cleveland Electric Illuminating Company; "The Trend of Socialism," by F. G. R. Gordon, New York City; and address by William A. Durgin, Commonwealth Edison Company, Chicago. The following committees will also present reports at the convention sessions: executive, station operating, new business co-operations, meter, illumination, transmission and distribution, finance, and standardization of voltages. About a score of electrical manufacturers will have exhibits of their products at the convention.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increased Rates and Adequate Service.—In sustaining a complaint of inadequacy of electric service against the Caruthersville & Kenneth Electric Light & Power Company, the Missouri Public Service Commission said that failure on the part of the company to comply with an order to provide satisfactory service would lead to a further investigation as to the propriety of maintaining the present increased rates. The company stated that every effort had been made to secure the additional machinery and materials, but that, owing to the war, it was practically impossible to secure boilers. Second-hand boilers that were promised could not be obtained, and materials for making changes in the present boiler plant were ordered, but shipment could not be secured. The defendant furthermore stated that it had had considerable trouble in maintaining an adequate supply of coal, and that the coal which was obtained was of a very low grade.

Amortization of Dismantled Plant.—In authorizing incrased electric rates for the Wright Brothers Light & Power Company, Ramsey, the Illinois Public Utilities Commission, in analyzing the accounts, notes that there is added to operating expenses $479 "to represent an amortization charge over a five-year period of the loss borne by the company through the dismantling of its power station. With reference to the latter item a showing is made as to the saving in expenses through the purchase of power as compared with the operation of the generation station. This analysis of the comparative costs of operation reaches a conclusion that the cost of energy from the oil engine plant amounted to 10 cents per kilowatt-hour without giving consideration to fixed charges upon the plant, while the cost of energy purchased from the Southern Illinois Light & Power Company under the present arrangement amounts to only 3.63 cents per kilowatt-hour, thus indicating a saving in excess of 6½ cents per kilowatt-hour. A showing of this nature is very convincing, particularly taking into consideration the fact that with an oil-engine plant of this character in a city the size of Ramsey continuous operation over a twenty-four-hour period is a very questionable method of operation from a financial standpoint, whereas with service from a transmission system twentyfour-hour service is, of course, assured, subject only to such interruptions as may be occasioned by failures of the transmission service. The evidence in this proceeding does not indicate that failures have been of a character to excite comment, and the citizens of Ramsey appear to be better and more economically served through this means of operation than they would have been had the oil-engine plant been continued. While under these circumstances the inclusion of an amount for the amortization of the old oil-engine system appears to present a forceful argument, it does not appear to be a determining factor in arriving at a decision as to the propriety of the rates now contemplated. For this reason the commission will not pass upon the equity of the inclusion of such an amortization charge." Beginning Oct. 6, 1916, the majority of energy necessary for the operation of the system was secured from the system of the Southern Illinois Light & Power Company, and the oil-engine plant which had previously furnished service was used as a reserve against the service from the transmission system. In June, 1918, this oil-engine plant was dismantled and certain parts were sold

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Regulation in Minnesota.—A law passed by the Minnesota Legislature and approved recently empowers any city of the third or fourth class in the state, whether existing under a special or general law, or under a home rule charter, through its city council or other governing body, to prescribe from time to time the rates which any public service corporation supplying gas or electrical energy for lighting or power purposes within said city may charge for such service.

N. E. L. A. Commercial Booklets.—The Commercial Section of the National Electric Light Association has addressed letters to central-station commercial managers inclosing copies of booklets soon to be printed by the association for distribution by member companies among consumers. One is the 1919 edition of "Electricity in Your Home," the other is entitled "The Right Way to Use Electrical Apparatus" and is intended to teach the public caution in handling irons and other appliances.

Japan Making Survey of Hydro-Electric Resources.—The Japanese government through the Bureau of Electrical Exploitation is conducting a five-year survey of the country's water-power resources. The work was begun in June, 1918, and a number of the twenty-two reconnaissance parties sent out have already completed the preliminary task of constructing gages, etc., in spite of greatly increased costs of labor and material. The power sites to be surveyed are those where more than 1000 hp. can be economically developed. In Japan at present about 1,000,000 hp. is already being developed, while about 2,000,000 hp. is under lease for exploitation.

New Jersey Industrial Directory.—The 1919 edition of the "Industrial Directory of New Jersey," just issued, contains facts and statistical details relating to the state's manufacturing industries and public utilities. One section of the volume is entirely taken up by a list of all the manufacturing plants operating in New Jersey, classified alphabetically according to industry, while the index to industrial opportunities of New Jersey gives a list of localities in which inducements of various kinds are held out to attract manufacturers. The directory was prepared by the Bureau of Industrial Statistics of the Department of Labor, under the direction of Commissioner Lewis T. Bryant.

Belgian Railroads to Be Electrified.—The Belgian Minister of Railways has ordered the electrification of the country's railways following the report of a committee which has been investigating the matter. The road from Brussels to Luxemburg will be the first line to be electrified, and the next will probably be that from Brussels to Ostend. It is planned to begin work in August of this year and to push the reconstruction of the properties as rapidly as possible on all parts of the project.

High Oil Prices Force Shut-Down of Alameda (Cal.) Municipal Plant.—Owing to increased cost of fuel oil the municipal electric light plant at Alameda, Cal., has shut down, and energy for the city is being supplied by the Great Western Power Company. The closing down of the plant has been discussed several times during the past ten years, but in each instance the popular outcry against such action caused the City Council to maintain it even at a loss. C. E. Hewes, city manager, is quoted as saying: "The city plant is shut down because the price of oil is now $1.60 or $1.65 a barrel, and the plant formerly bought oil for 65 cents a barrel. It was costing too much money to generate electricity. We had to run at a loss, so we shut down the plant and are buying electricity on a sliding scale, the price depending on the amount of juice consumed."

Educational Conference Calls for Engineering-Business Training.—At the last session of the conference on business training for engineers and engineering training for students of business, held recently at the New Willard Hotel, Washington, the following resolutions were unanimously adopted: "Whereas, industrial and commercial development has created a demand for men with technical engineering training and business ability, manufacturing institutions are seeking engineers to qualify to serve in capacities requiring sound business training, banks and brokers also need men with engineering and business training, and this need is rapidly increasing and bids fair to demand a large number of technically trained men for both foreign and domestic commerce, it is the sentiment of this meeting that to meet this demand economic phases of engineering subjects should be emphasized wherever possible in engineering institutions. This can be done by introducing courses in engineering economics, cost accounting, business law, etc., into engineering curricula, and engineering phases of economic subjects should be empnasized wherever possible in commercial instruction. It is also urged upon all institutions with departments in engineering and economics or commerce that they consider some plan of coördination to develop a course in preparation for those careers wherein training in the essentials of engineering and business theory and practice have been found to be both helpful and necessary."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

City's Use of Poles of Electric Company.—Where an electric light and power company had erected poles for its wires an ordinance giving the city the right to the use of the top gain of such poles for city purposes amounts to taking of property without compensation, according to the Supreme Court of Vermont (106 A. 513).

Use of Streets by Electric Light Company.—A city has no proprietary right of compensation for use of streets by an electric power company for a line of poles and electric wires, the right of granting the privilege of occupying streets for such purpose being primarily with the Legislature, according to the Supreme Court of Vermont (106 A. 513).

Unauthorized Agent.—Evidence, in an action of a foreign firm to recover against a domestic electric and ice company for repairs on a motor furnished by a city to the company for pumping water, the Supreme Court has held, does not sustain a defense that the company was acting for the city in having motor repaired so as to require city to pay for repairs (180 P. 703).

Adjudication of Water Rights.—The law giving the state hydraulic engineer the power of determining water rights does not divest the superior court of jurisdiction in action to quiet title to interest in water and to enjoin interference with water rights, where the court acquired jurisdiction prior to the taking effect of such statute, according to the Supreme Court of Washington (180 P. 894).

Charges for Light and Power as Rental.—On appeal from order granting plaintiff's motion for judgment on the pleadings, pursuant to the Code of Civil Procedure, in action for rent under agreement for monthly hiring, the Supreme Court of New York has held that complaint is not demurrable in so far as charges for light and power are concerned, rendering it unnecessary to consider allegations concerning rental (176 N. Y. S. 65).

Necessity of Circuit Breakers.—The maintaining of an electric light and power plant transmitting 33,000 volts over wire constructed over a public road, without ammeter, circuit breaker or ground detector is negligence little, if any, less than criminal, and the operators must be held to have anticipated severe shock or death from the breaking of a wire without shutting off the current, according to the Court of Civil Appeals of Texas (211 S. W. 600).

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. J. Corbett, formerly professor of electrical engineering at the University of Idaho and for the past year captain of engineers on duty in the office of the chief of engineers, Washington, D. C., has taken up work with the Federal Board for Vocational Education at San Francisco.

T. H. Fritts, the president-elect of the Nebraska Section, National Electric Light Association, has been an official of the Grand Island (Neb.) central station for more than thirteen years. Originally he came to Grand Island to make some recommendations regarding the electric property there, which was then controlled by B. E. Sunny, Chicago, its president. Before those negotiations were closed Mr. Fritts was made vice-president and treasurer of the company. Later, when the property was

THOMAS H. FRITTS

acquired by the Middle West Utilities Company of Chicago and became known as the Central Power Company, Mr. Fritts was retained in the same capacity.

J. C. Johnson, recently appointed general manager of the Iowa Southern Utilities Company with offices at Centerville, Ia., has been associated with David G. Fisher & Company, public utility engineers of Davenport, Ia., for the last two years. During the war Mr. Johnson, as representative of the Fisher company, had charge of the office of the Associated Manufacturers of Davenport at Washington, D. C. This office was the clearing house of Davenport manufacturers and the governmenton war contracts and was instrumental in having approximately $25,000,000 war contracts placed with concerns at Davenport. Mr. Johnson was graduated from Lewis Institute in 1909 and soon afterward accepted a position with the Commonwealth Edison Company, Chicago. He was engineer at the Fisk Street station in that city in 1912. Subsequently he went with the Westinghouse company, remaining there until 1917, when he accepted a position with the Fisher company.

Paul A. Westburg, president of the Westburg Engineering Company of Chicago, has been elected secretary of the Rotary Club of that city.

J. E. Warren, who for the past three years has served as line foreman with the Texas Power & Light Company, has been appointed City Superintendent at Bryan, Tex.

Raymond C. Sherman, who was superintendent of the Deerfield River Power Company, has been promoted to the position of superintendent of the Connecticut River Power Company. Both of these concerns are under the management of the New England Power Company.

Col. H. M. Byllesby, president of H. M. Byllesby & Company, who served as purchasing agent for Great Britain and Scandinavian countries for the American Expeditionary Forces, with headquarters in London, has had the English Distinguished Service Order conferred upon him for important assistance rendered the British government during the war period.

Albert Brunt, who for the last four years has been engineer in charge of the direct-current machine design section of the industrial engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has resigned to return to Holland, his native country. Mr. Brunt came to America in April, 1909, and entered the engineering department of the Westinghouse Company. He has been an active member of the American Institute of Electrical Engineers and prepared a number of interesting articles on direct-current motors for publication.

George W. Lawrence, who has succeeded Philip Cabot as president of the Turners Falls (Mass.) Power & Electric Company, is well known in Eastern central-station circles. A native of Gardiner, Me., he was graduated in 1898 from the University of Maine in the electrical engineering course and served in the Spanish War in the Signal Corps of the United States Regulars. For about a year after the close of hostilities Mr. Lawrence was incapacitated by disabilities in the line of military duty. He then entered the employ of the United Shoe Machinery Company at Beverly, Mass., to obtain shop experience, and after about a year accepted a position in the Boston Navy Yard, where he continued to specialize in machinery operations. For about a year he was electrical engineer of the American Smelting & Refining Company with headquarters at Monterey, Mexico. He then entered the Schenectady works of the General Electric Company and after taking the expert course became attached to the Boston office as a construction engineer. About 1904 he went to Greenfield, Mass., to superintend the installation of various equipment for the Greenfield Electric Light & Power Company, and the quality of his work led to his employment as manager of the local system. As the electrical properties indentified with the Turners Falls company and the banking house of White, Weld & Company, Boston, expanded Mr. Lawrence's duties were enlarged, so that just before his election as president of the Turners Falls company he was resident manager of the seven allied utility properties in the Con-

G. W. LAWRENCE

reticut Valley, namely, the Greenfield and Turners Falls companies, Easthampton Gas Company, Amherst Gas Company, Franklin Electric Light Company, Ludlow Electric Light Company and Agawam Electric Company. Mr. Lawrence is vice-president of the Fall River (Mass.) Electric Light Company and is a member of the Engineers' Club of Boston. His headquarters are at Greenfield, Mass.

George M. Wood has been appointed supervisor of power plants for the Connecticut Company, New Haven, Conn. Mr. Wood has been connected with the Connecticut Company in the power department for a period of eight years, first serving for two years as draftsman and later being connected particularly with erecting jobs on the company's power plants and heating systems. In 1913 he was made assistant engineer in the operating department and in 1915 was transferred to the construction department. Mr. Wood is a native of the town of Branford, near New Haven, where he still resides. He was graduated from the Sheffield Scientific School of Yale University, in 1908, from which he holds the degree of Ph.B.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

COPPER WIRE TAKES ANOTHER CENT ADVANCE

Volume of Sales Increase and Shortages in Some Kinds and Sizes are Already Reported—Foreign Markets Also Show Activity

Wire is steadily increasing in price as a result of the almost daily higher copper prices. Within the past week an advance averaging 1 cent per pound was made in most every make of copper wire.

Rubber-covered wire on Monday morning was on a 23 cent base. Weatherproof and slow burning was quoted from 22 to 23½ cents base. Lamp cord was quoted at 23 cents and 25 cents base. Bare wire was 21 to 22½ cents base and annunciator was higher this week at from 28 to 36½ cents base, depending on the manufacture.

The volume of wire sales is getting larger right along. Wire mills are most conspicuous of the copper buying interests. Reports of shortages on certain sizes of weatherproof, particularly No. 10 and flexible armored conductor, are coming in from different sections of the country. Strikes in the New England Section have not helped deliveries any.

Silk-covered parallel conductor is finding a better demand for fixture and Christmas tree outfit use. Enamel wire is also selling better. A second order for the Ford factory for 50,000 lb. was received last week. A much better market for bare wire is reported. An order for 3,000 miles bare wire was placed last week by the Postal Telegraph. Considerable other business is coming through from central stations and telephone companies. The Texas oil fields are buying bare wire. Trolley wire is being sold in one mile lots.

Foreign inquiries for wire of all kinds are coming in in larger numbers, although the export trade in American wire has grown by leaps and bounds during the last three or four years.

ENGLISH ELECTRICAL EXPORTS INCREASING

Very Few American Incandescent Lamps Being Imported by England—Other Imports Show Up Better

English exports of electrical goods are running about 80 per cent ahead of last year, according to the figures for the first four months of the current year. This is still below the pre-war figures and is about 40 per cent of current electrical exports from the United States. January exports amounted roughly to $1,900,000, February to $1,600,000, March to a little more than $2,000,000, and April to $2,300,000.

Imports of electrical goods into England for the first four months of the current year, in round numbers, were as follows: January $475,000, February $800,000, March $800,000, April $980,000. It is interesting to note that during the first four months of this year electrical goods of American manufacture were sent to England as follows: January, $175,000; February, $535,000; March, $421,000, and April $395,000.

It is very difficult to compare American exports to England with British imports, because of the time difference for transportation, and also because the difference in customs classification. However, one thing is apparent from a study made of the trade for the first four months of 1919, that is, England is importing hardly any American incandescent lamps, although the English import trade in lamps is very large. Thus in January England imported $118,000 of incandescent lamps, in February $103,000, in March $177,000, and in April $280,000. In the months of January and April no American lamps went to England, and in February and March $300 in the former month and $54 in the latter month.

ELECTRIC REFRIGERATING MACHINES FOR RESIDENCES

Big Future Is Seen for the Business When Machines Are Manufactured on a Quantity Production Basis

The business of manufacturing electrically-driven refrigerating machines for residential use is on the verge of a boom. Millions of dollars have been and are still being spent in development work which has gotten to a point where returns are in sight. Two of the strongest companies in the business, financially, each claim to have solved the problem. The demand is so great for their comparatively small output that the machines are disposed of with practically no selling effort. The number of manufacturers that are planning to go into this business and the preparations now being made by the older manufacturers for quantity production, make some motor manufacturers prophesy that the fractional horsepower repulsion motors required to drive these machines will rival the demand for split-phase motors for washing machines. At least one of the motor manufacturers is figuring on going into the manufacture of a residential refrigerating machine and one of the large jobbing organizations of the country has contracted for a five years' supply of a new machine.

Most of the machines are rated at about 200 lb. of refrigeration per twenty-four hours and cost about $400 or $500 installed. It is not likely that very much smaller machines will be brought out until some of the development expense has been absorbed by the present machines. For people who have money machines of this size are not too large and greater sales effort would be required on smaller units going to less wealthy purchasers. Development in this direction is merely a question of time.

WATT-HOUR-METER MARKET DISPLAYS IMPROVEMENT

Factories Are in Position to Take Care of Demand Incidental to Boom in Building—Prices Expected to Remain Firm

Within the last two weeks the watt-hour-meter market has revived considerably, owing to the gradual increase in building construction in different parts of the country. The demand has not attained normal proportions as yet, but a very rapid increase in sales is anticipated within the next two months. This is believed to be the certain outcome of the expansion in building likely to follow the conclusion of peace and forced to go forward, regardless of cost, by the pressure of population upon existing housing facilities. Gradually, also the central stations are taking up their line-extension work long held back by war conditions, and this, with the necessary development of some new generating plant and substation facilities in local communities of the forward-looking type, is a positive factor in market enlargement.

Should a country-wide building boom occur, as many observers believe will be the case, the factories will be able to meet the present year's demand for meters without very much difficulty. Equipments for residential service are well standardized, and the benefits of mass production can readily be realized. Labor costs are high, and materials are up also, but by and large meters did not go up during the war as far in proportion to their pre-war prices as did many other types of electrical apparatus. The present level of about 40 to 50 per cent above pre-war prices is not likely to show weakness. There is little salvage in worn-out or obsolete meters; the cost of copper and insulation trend upward rather than downward, and while some market observers believe that the present price of steel is being artificially maintained, the prospects of continued high labor costs are so clear that if any change in prices occur during the coming six months, the differential is apt to be positive. Production methods are well organized, however, and unless labor demands unreasonable compensation, a prosperous period looms ahead for the meter manufacturer.

In spite of the present lull in new industrial construction a fair demand for so-called "power" meters is now being handled. Betterment work in industrial and mercantile establishments absorbs many such units, and the central stations are almost always in the market for meters not regularly carried in public utility stock rooms in any considerable number. It would seem that non-competing adjacent utilities might profitably pool their lists of power meters in stock for use on electrically similar systems, and thus reduce the overhead charges on such equipment, while gaining the benefits of immediate neighborhood deliveries. All in all the meter market is showing decided signs of new life, and there seems little reason to doubt that the days of minimum demand have passed.

BETTER MARKET SEEN FOR ELECTRIC CRANES

Production of Direct-Current Equipment Larger, on the Whole, than of Alternating-Current Types—Prices Not Likely to Fall

Following the termination of hostilities the electric crane business continued in considerable volume until orders placed before the armistice had been filled. Then production fell off to a great extent, but it picked up when lower prices for iron and steel were suggested by the Industrial Board on April 2. In the short time that elapsed before the Railroad Administration refused these prices there was a noticeable increase in electric crane inquiries. One manufacturer stated that in this period he had more inquires than in the corresponding period of 1917 and 1918.

But the inactivity of the steel market early in May was reflected in very little crane business, and even up to the present time there is little crane activity in the industrial world. The E. W. Bliss Company, Brooklyn, N. Y., has ordered three 30-ton and three 50-ton cranes. However, there are twenty-two cranes needed for the naval ordnance plant in Charleston, W. Va., and about fifty cranes for handling cargo on the New York State Barge Canal.

Crane manufacturers look for an active demand soon for cargo-handling cranes. New terminals are to be provided at Providence, R. I., Portland, Me., New London, Conn., Seattle and San Francisco, but the only city which has as yet taken bids is Providence. Inquiries for standard bridge cranes have been fairly numerous during the past thirty days, but many of these are for estimating purposes. One crane manufacturer says that not more than 10 per cent of these inquiries have resulted in orders.

In the experience of one manufacturer the production of alternating-current and direct-current cranes was about equal during the last few years. Others find the alternating-current much below the direct-current production and increasing very little.

Prices of electric cranes have declined about 20 per cent since the first of the year, but no further change is anticipated.

APRIL ELECTRICAL EXPORTS AMOUNT TO $7,709,138

Figures for First Four Months of Current Year Total Up to $29,874,104, or at Rate of Almost $90,000,000 for the Year

April exports of electrical goods amounted to $7,709,138, the second largest month on record. This brings electrical exports for the first four months of the year up to $29,874,104, which is on the basis roughly of $90,000,000 for the calendar year.

Exports of generators, heating and cooking equipment, interior wiring supplies and telephone materials hung up new records in April last. The April exports of generators amounted to $512,894, of heating and cooking appliances to $153,342, of interior wiring supplies to $218,031, and of telephone material to $426,373. Norway, England, Canada, Uruguay and Japan stood out in receipts of heating and cooking equipment; Spain, Canada, China and Japan in generators; Canada, Brazil and Chile in interior wiring supplies, and Italy, Canada, China, Dutch East India and New Zealand in telephone material.

Figures for the ten months ended April amounted to $61,981,072, in comparison with $44,514,063 for the corresponding period a year previous.

Figures in the accompanying table are taken from compilations by the Bureau of Freight and Domestic Commerce.

	April		Ten Months Ended April	
	1918	1919	1918	1919
Batteries	$268,294	$547,430	$2,770,627	$3,496,919
Carbons	130,577	102,642	1,294,230	1,367,542
Generators	307,911	512,894	2,111,289	3,250,649
Fans	104,503	96,433	532,922	965,075
Heating and cooking appliances	38,959	153,342	436,311	883,576
Insulated wire cable	457,354	767,088	5,046,442	6,401,514
Interior wiring supplies (including fixtures)	136,471	218,031	1,253,454	1,465,615
Arc lamps	2,430	2,889	12,133	13,082
Carbon-filament lamps	7,365	13,100	130,317	116,861
Metal-filament lamps	278,150	452,151	2,397,840	3,500,096
Magnetos, spark plugs, etc.	230,719	312,188	2,839,220	2,509,369
Meters and measuring instruments	157,730	248,890	1,222,470	2,053,480
Motors	560,071	829,113	5,502,785	8,297,715
Rheostats and controllers	14,805	30,798	159,373	304,551
Switches and accessories	163,076	230,840	1,892,256	1,814,253
Telegraph apparatus (including wireless)	36,167	106,769	250,299	602,495
Telephones	172,912	426,373	2,040,335	2,472,671
Transformers	156,951	308,669	1,664,815	3,658,300
All others	1,348,558	2,349,498	12,956,945	18,807,315
Total	$4,572,955	$7,709,138	$44,514,063	$61,981,072

NEW DEVICES INCREASE CALL FOR FRACTIONAL-HP. MOTORS

Customers Ordering Ahead to Have Motors Shipped on Schedule—Use of Repulsion Motors Growing

Manufacturers of fractional-horsepower motors expect the household refrigerating machine to be the next big user of small motors. Companies with plenty of capital are making successful refrigerating machines for the home and are beginning to get into quantity production. Many other concerns, including one of the well-known motor manufacturers, are figuring on manufacturing these machines. One of the large jobbing organizations of the country signed a five-year contract to handle a domestic refrigerating machine which is not yet on the market. Practically all these machines are equipped with ¼-hp. repulsion motors and are rated at about 200 lb. of refrigeration per twenty-four hours. Smaller machines may be put on the market later, but the present size is not too large for most of the people who have the money to buy them. However, the tendency is toward the manufacture of smaller and cheaper refrigerating machines for which smaller and cheaper motors will be required.

Portable electric machine tools are also being sold in increasing numbers, and their requirements for motors are about half repulsion and half split-phase. The household churn is one of the new socket devices calling for split-phase motors. The demand for the split-phase motor is still increasing in the sizes up to ½-hp., but the repulsion-motor business is growing more rapidly.

Buyers are placing orders for their fractional-horsepower motor requirements up to a year ahead and are having the motors shipped according to schedule. Only by adopting such a policy is it possible to insure delivery. New device manufacturers have been quoted deliveries up to about ninety days for special motors built to meet their requirements. Some motor manufacturers cannot do better than three months' delivery on quantities of standard motors. The best delivery one manufacturer can give on even small orders like twenty ½-hp. motors is thirty days, whereas in pre-war times the motors would have been taken out of stock.

METAL MARKET SITUATION

Copper Is Up Another Half Cent—Sales for Late Fall Delivery Are Discouraged

Copper quotations are up ½ cent to 18.75 cents, while late July quotations are at 18.87 cents and August at 19.00 cents. All classes of dealers are holding for these prices. One small interest quotes 19 cents for September, but the larger selling agencies are declining to establish a level for that month. Fourth-quarter sales are being discouraged by the attitude of producers. London spot copper is quoted at £87 in a strong market. Copper sales show more activity on a firm market. Foreign sales are showing a tendency to increase and continue strong in tubes, rods and wire. Brass and copper products rose 2 cents a pound on June 27, and leading mills are quoting sheet copper at 27.50 cents a pound, sheet brass at 22.75 cents and seamless copper tubing at 32 cents a pound.

The wage agreement which the Anaconda company made with the miners several months ago expired July 1, and considerable interest is felt in the outcome.

Exports last week were rather small, most of which were wire, rods, sheets and tubes to Holland. June exports are a little higher than May.

Lead prices remain unchanged with a rather satisfactory demand, although labor shortages have been causing producers considerable delay in making shipments.

The scrap metal market has shown considerable activity this past week, but it is expected that still greater activity will be found in the near future with enlarged business needs. Only small changes in price have been noted.

NEW YORK METAL MARKET PRICES

	June 26	July 1
Copper:	£ s d	£ s d
London, standard spot	87 5 0	87 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18.62½	19.25
Electrolytic	18.25	18.75
Casting	17 75	18.25
Wire base	20.25 to 20.75	20.50 to 20.75
Lead, trust price	5.40	5.40
Antimony	8.37½	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.90	7.35
Tin	70.00	70.50
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.00 to 16.50	16.00 to 16.50
Brass, heavy	8.50 to 9.25	8.50 to 9.50
Brass, light	7.75 to 8.25	7.75 to 8.25
Lead, heavy	4.75 to 4.87	4.75 to 4.87
Zinc, old scrap	4.75 to 5.00	4.75 to 5.25

THE WEEK
IN TRADE

ALREADY reports of better business as a result of the beginning of peace are coming in. All indications are that the stage is now set for a boom in electrical business. Stocks are in readiness, except for flexible armored cable, circular loom, some sizes of weatherproof wire and certain domestic appliances.

Deliveries on many items are again beginning to buy them out, as demand increases, and it would not be surprising to find deliveries generally a week or two or more behind by the fall.

Prices are showing a decided upward trend. Wire, storage batteries and certain wiring materials are higher this week. Some of the other materials appear to be on the verge of an advance.

Labor is restless here and there. The telephone strike on the Pacific Coast threatens all electrical workers there. Collections so far as can be learned are in good shape.

NEW YORK

The jobbing trade has reported business holding about the same as the last week with prices, except for wire, steady. Flexible armored conductor is stlll in small supply.

Wire and cable sales from manufacturers are coming along in a little better shape, with better emphasis on wire for telegraphic communication. Fan sales are rather quiet in the absence of long continued hot spells.

Labor conditions in the brass mills are becoming more settled and nothing has appeared to postpone the expected speedy settlement.

LAMPS.—Samples of the new 50-watt, tipless, opal glass C-4 lamp are in jobbers' hands, but stocks have not been delivered. One jobber does not expect to order stocks now; but will wait to see what the demand is rather than create it. List price is 65 cents.

FLASHLIGHT BATTERIES.—Sales have been picking up on batteries for the tubular and the more popular flat types.

IRONS.—One jobber reports the electric iron business fair, but believes a cheaper grade is in demand.

HEATING DEVICES.—An increase in sales of table ware is reported by one manufacturer.

ATTACHMENT PLUGS.—Sales of all kinds of attachment plugs, receptacles and switches are increasing to a satisfactory extent, according to a prominent producer. An additional 5 per cent to jobbers on one attachment went into effect on June 25.

TIME CLOCKS.—Although sales of time clocks for street lighting purposes are continuing right along, they are increasing in volume for sign lighting and show window lighting. Prices remain the same although tending upward.

LIGHTNING ARRESTERS.—Pole type arresters are running in good volume, and more central stations are following the policy of placing them at every transformer point rather than at more or less arbitrarily assigned points along the lines.

MOTORS. — Single-phase motor business in general is good. In particular, sizes from ½ to 5 hp. are selling in fine shape for application to bakers' machinery, for refrigeration in butchers' shops and other small establishments, and for pump work for irrigation purposes and house systems in the country. In some cases deliveries are behind. The demand for fractional horsepower motors for household appliances continues as usual.

WIRE.—Rubber-covered base is up 1 cent to 23 cents, with seven manufacturers quoting on 23 cents, two on 22 cents, one on 21 cents, one on 25 cents and one on cost. Bare and weatherproof bases are also up about one cent.

CHICAGO

The extent and number of new transmission lines being constructed by the utilities in the Middle West is unprecedented. This new construction is not limited to the larger companies. One jobbers' salesman sold material for a 70-mile line to a company which is practically unknown outside the district it serves. Building permits in Chicago dropped off somewhat from last week's showing, but they are nevertheless above the average of the past few months. Over six million dollars of new building projects were announced during the week, and this included over a million dollars for apartment buildings, a million dollar hotel, and a million dollar and a one and a half million dollar theatre. A housing committee has been organized in Chicago to relieve some of the congested districts by purchasing tracts of land and building homes for working people to be sold at cost. The present plans call for an expenditure of about one million dollars. The housing Financing Corporation of Detroit has similar plans for relieving the congestion in that city. The general advance of about 15 per cent in the price of building materials is expected within the next sixty days, has given an impetus to all building projects.

Labor is very unsettled in Chicago at the present time. Manufacturers are complaining that the efficiency of labor has not returned to pre-war standards, and this is given as the principal reason for some of the price increases which are being made.

COPPER WIRE.—The demand for rubber-covered wire is still strong, and the base of 22 to 24 cents has not been changed during the week. The demand for weatherproof is very heavy, and jobbers' stocks are getting low. One jobber is entirely out of No. 8 and No. 10, and factory deliveries are about ten weeks for eight and ten-gage weatherproof. Some factories cannot even make this delivery on account of strikes Bare wire is on a 22-cent base, and there is an exceptionally heavy demand for new transmission lines.

STEEL CORE ALUMINUM WIRE.—Stranded wire of this description is being used extensively for transmission lines because of a differential of about 15 per cent in its favor compared with copper of the same conductivity.

RIGID CONDUIT.—The demand is exceptionally light. What is being sold is being used mostly for new buildings. Industrial plants are not buying.

FANS.—Some jobbers have a few oscillating fans left but their stocks of the 12-in. and 16-in. sizes are practically exhausted. Fair stocks of 12-in. and 16-in. non-oscillating fans are still available.

LIGHTING FIXTURES.—There is a good demand for lighting fixtures from wholesale and retail merchants, both for expansion in business, and to replace obsolete equipment. All the indirect lighting products of one manufacturer were increased an average of 15 per cent on July 1.

REFLECTORS.—The showcase reflectors of one manufacturer were increased about 10 per cent this week, but there was no change in the price of his other reflectors or projectors.

STORAGE BATTERIES.—Business is very good, especially in the line of starting and lighting batteries for gas cars. One manufacturer increased his prices 10 per cent on the first of this month.

ELECTRIC ROAD TRUCKS.—One of the leading manufacturers of this equipment is enjoying the greatest business in the history of the company. Deliveries are still being made promptly, and no price change is contemplated.

SMALL MOTORS.—One manufacturer has made adjustment in the list prices of slip-ring motors, and discounts. Another manufacturer has also made adjustments in the list prices of practically all motors, and has changed the discount from a frame basis to a horsepower basis. The tendency in the price adjustment was generally a few per cent reduction in list price, but in some few cases the prices are higher. There has been practically no change in the single-phase motor prices, which were reduced 10 per cent about six weeks ago.

BOSTON

Business shows signs of improving with the signing of the Peace Treaty. Within the last few days inquiries in many lines have greatly increased. Jobbers are exceedingly active and June collections are reported better than in May. An agreement in the building trades between employers and employees has been reached, with provision for 1919-1920 wages on the basis of 90 cents per hour for major trades until April 1, and $1 per hour thereafter. The removal of uncertainties as to wages and the release of capital by the signing of peace are expected to result in a rapid stimulus of trade in this district. Many construction projects will now go forward. Improvement in the textile field is marked this week. Prices of electrical materials show no tendency to weaken, though some fluctuations are noted in the storage battery field. Some anxiety is heard regarding future deliveries in washing machines and vacuum cleaners. The shortage in armored flexible conductor continues. Appliance sales are being maintained along the highly satisfactory volume of output noted of late. Labor conditions are less disturbed this week. Jobbers' stocks are being well kept up, but it is probable that increased buying will soon be necessary to enable sufficiently prompt deliveries to be made. Little excuse appears to exist at present for further deferring buying from the manufacturers for fall delivery.

MOULDED INSULATION.—Although the demand is somewhat below the high water mark of war requirements, the volume of sales and of product being marketed is greater than in 1914. The automobile industry continues to absorb this material in quantity. Prices are steady. Factory deliveries are excellent.

SCHEDULE MATERIAL.—The building trade is improving throughout the country, and increased demand for wiring supplies is noted by New England manufacturers. Except in a few lines, stocks are ample, but longer deliveries are expected in some circles before many weeks, should the building trade develop the expected activity. The importance of standardization as a factor in keeping costs from rising is beginning to be recognized.

ELECTRIC PASSENGER CARS.—Trade is improving rapidly and in some places deliveries are unequal to the demand. Prices tend to stiffen, but unless the advance is of the order of $750 to $1,000 it does not appear to affect the market adversely. The agency of the Detroit company at Hartford, Conn., contemplates building a new service station.

STORAGE BATTERIES.—Prices are showing some fluctuation. Lead batteries were reduced about 10 per cent within the fortnight. Alkaline batteries were expected to advance about 10 per cent July 1. The volume of business seems to be increasing somewhat, but the demand is still rather uneven. Inquiries are coming in admirably, but up to the end of last week some distributers reported sluggishness in the placing of orders. Stocks are in fairly good shape at present.

LAMPS.—The market is good, despite the fact that this is about the "low point" of the year's use. Many industrial establishments are running lower in their local stocks of lamps and orders for the fall service will shortly be in the mails. The demand for ornamental and sign lamps continues good. Portable lamps, especially of the moderate priced designs, have sold extremely well of late, considering the time of year.

FANS.—Cooler weather has lowered the retail demand somewhat, but the good start secured in the earlier hot "spell" is still felt in buying from jobbers. Shipments are still coming in from the factories, and the demand appears to include nearly all standard types.

WIRE.—Prices are running stronger. Bare wire was quoted around 21⅛ cents base at the end of last week, weatherproof at 23 cents and rubber-covered at 24 to 25 cents. Buying increased considerably toward the end of last week. Stocks are in pretty good shape, except as to circular loom and armored flexible conductor. The former is running about 20 per cent in advance of the prices of a

week or so ago and the latter shows gains averaging about 5 per cent in price. The shortage of armored flexible conductor is now acute in New England.

INDUSTRIAL ELECTRIC TRUCKS.—An improved demand in the textile field is noted.

ATLANTA

Business in all lines is intensely active and jobbers are being called upon for larger quantities of schedule material which is in ample supply, being replenished from prompt incoming shipments. Figures compiled to date indicate that the value of building permits for June at Atlanta will be considerably in excess of the record figure attained for May construction. The boom on residence building is phenomenal, and the lumber trade is having difficulty in supplying the growing demand. Prices are naturally seeking a higher level and no reduction in building materials is looked for in the near future.

TURBINES.—Manufacturers report business as being quite active. Orders secured in June from 1,000 to 10,000 kw. were beyond expectations. Inquiries are becoming more numerous and a still greater market is looked for. Transactions appear to be evenly divided between municipal plants and industrials. Increased buying is noted from the Florida phosphate fields. Shipments have been materially reduced compared with the war-time promises. Deliveries are now running from three months on the smaller capacities to six months for the larger.

ELECTRIC PORTABLE SEWING MACHINES.—Trade is brisk and dealers report difficulty in securing deliveries from factories. An advance of $2.50 per unit is rumored.

WASHING MACHINES.—There is no cessation in the demand for all makes and sizes. Factories deliveries are slowing up and it is almost impossible to secure any reasonable shipment on the larger equipments. A few jobbers are fortunate in having a well balanced supply.

FANS.—There is little change over last week with the exception of perceptible falling off in volume due to cooler weather. The season was delayed this year, but it is expected that stocks will be cleared up fairly well through July and August. No shortage is apparent at this time.

STREET LIGHTING EQUIPMENT.—Transactions are becoming more numerous and the general market is strong. Central stations are more aggressive in the buying field, and this feature combined with the demand for mill village lighting makes for great activity. Total sales to date are 50 per cent ahead of 1918.

METERS.—The demand for the 5 amp. capacity is excellent. Renewed activity on the part of central stations covering extensions for new building operations has tended to stimulate this item. No price changes are anticipated. Prompt deliveries are being made from local stocks.

WIRE.—Prices are unsettled with the trend upward. Weatherproof is offered at 22 cents base and rubber-covered at 21 cents. Shipments are good with the exception to No. 10 weatherproof which cannot be had now.

TRANSFORMERS.—Orders are coming in from all quarters, following closely the present call for meters. Manufacturers are looking forward to a still greater volume of business and orders are being placed on the factories for fall delivery on this basis. Stocks are well distributed throughout the southeast, assuring prompt shipments.

VOLTAGE AND FEEDER REGULATORS.—For a time it looked as though these items would follow the field but transactions have dropped off and the market is practically lifeless. Prompt shipments are offered. Prices remain firm.

VENTILATING FANS.—Equipment up to 16 inch are going good and sales are better than at the same period a year ago. Restocking has been done at several points. Shipments from eastern centers have kept up local stocks.

LAMPS.—The increased buying from normal industrial and commercial channels has offset the decline in government purchases, and compared with this time last year, total sales show an increase. No shortage of any type is noted.

SEATTLE—PORTLAND

Northwest jobbers and dealers, particularly those in Seattle, report that during the past week business was featured by heavy and increasing sales of domestic appliances. Washing machines and vacuum cleaners easily led the field, closely followed by electrical tablewear. In Seattle sales of electric ranges are more or less retarded on account of lack of energy as both private and municipal plants are loaded to capacity. Increasing domestic demand for electrical equipment is indicated by the large number of applications to the municipal plant for power which cannot be furnished. Appropriations have been made by the city council for extensions to the city plant.

Renewed confidence is expressed by steel shipbuilders and allied industrial enterprises in the signing of the peace pact. It is believed that if the Federal Shipping Board does not renew cancelled contracts or negotiate new ones foreign governments will renew offers of ship contracts. The volume of sales of electrical equipment to yards and industrial plants is still running light. The few sales to saw mills and lumber plants which are undergoing usual mid-summer repairs are not heavy for large equipment, although small motors are moving well. Sales of small motors to canneries and fruit by-products plants are beginning to materialize. The demand is largely from the Puget Sound section and the southwestern part of the state. Grain elevator companies in Inland Empire district, near Spokane and Walla Walla and in southeastern Oregon are buying smaller motors in considerable quantities. Farm lighting plants are going good in this district. Retail dealers in Seattle report that the fixture business shows marked increase over last month, which was considered a banner month. Residence building continues unabated. Collections are reported as good in Puget Sound cities. Out-of-town collections are coming through fairly well.

SAN FRANCISCO

From all sides come reports of renewed building activity, especially for private residences. There are not so many larger buildings reported, the tendency being to remodel.

The labor situation is acute after a long quiescence, the telephone strike still being unsettled and there being threats that electrical unions of all sorts will be called out.

Export business has been rather quiet, because of the uncertainty of the acceptance of peace terms, which with other factors, gave rise to a cautious spirit among investors in foreign enterprises. But the actual signing of peace and the availability of ships, together with the presence of a fine Pacific Fleet of United States war ships, should restore former conditions in export business.

FUSES.—Sales of both inclosed and refillable fuses have fallen off in several fields. First, because of fewer large installations, and second, because of industrial slowing down. The refillable fuse field has been complicated by the entry of a number of new manufacturers, and the conflicting types of refills, are gradually producing a condition like that of the inclosed fuse field before the 1905 standardization of sizes.

CONDUIT.—A sharp drop in the price of flexible nonmetallic conduit was followed by a 20 per cent raise that put the prices within 10 per cent of their former figures. With this difference, that in accordance with the new policy of allowing liberal discounts on extra large quantities, the 5,000-ft. price of approximately $25 per thousand feet on the standard size for number 14, single braid, solid wire, gives the dealer an opportunity to save money. Steadily growing sales are reported with a peak predicted for September.

POLE LINE HARDWARE.—In conformance with this policy of quantity prices, renewed now after a lapse of several years, standard pole line hardware may be assorted in lots of 5,000 pieces or over at a discount of 5 per cent from the 100 lot price. Several pretty fair jobs, on which the pole orders have already been let, are now being figured upon.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
1	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
¾	.09	1½	.40
¾	.12	1¾	.47
¾	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00	$20 75	$21 50
½-in.—	30.00	21 50	20 50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
⅜-in.—	$33.00	$17.50	$16 25
½-in.—	36.00	19.00	17 25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 40

Size, In.	Conduit, List per Foot
⅜	$0.08½
½	.08½
¾	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	58½
3	76½

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
⅜	$0.05	$0.19
½	.06	.19
¾	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	⅜ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅜ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 6.1%	2% to 8.1%
2500 to 5000 lb.	+1% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6 50 to $7 50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$26.47–$35.01
Coil to 1000 ft	23.82– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00
Coil to 1000 ft	21.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4It, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–35%	20%–35%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33% 40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	25%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.43
No. 18, full spools	.35– .41

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46 to $0.56
No. 18, full spools	.41 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$15.00	$12.65–$14.00	$9.25–$10.60
12	19.26	19.26	14.45
10	26.04	26.04	17.36
8	35.82	29.85	23.88
6	56.70	47.25	37.80

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.50	$10.00–$11.00	$9.50–$10.00
12	22.05	22.05	18.90
10	29.68	29.08	25.44
8	40.59	34.62	24.62
6	63.84	54.72	54.72

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$28.00–$29.25
25 to 50 lb	28.00– 25.25
50 to 100 lb	27.00– 25.25

CHICAGO

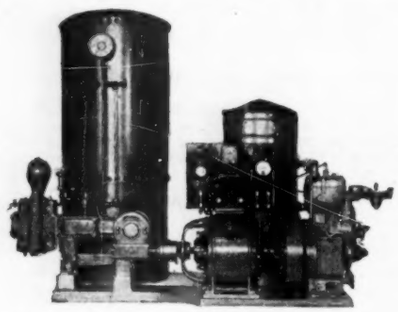
	Per 100 Lb. Net
Less than 25 lb	$25.75 to $26.50
25 to 50 lb	25.75 to 26.50
50 to 100 lb	25.75 to 26.50

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Directly-Connected Pump and Electric Plant

Storage battery charging and water pumping can be accomplished simultaneously by means of an outfit manufactured by the Kewanee Private Utilities Company of Kewanee, Ill. The pump is operated by a noiseless worm gear running in a bath of oil and furnishes water and air for pneumatic tank service at all times. By pressing a button on the switchboard of the electric plant both charging generator and pump are placed in operation. When the required pressure is reached in the water tank, an automatic switch stops driving engine and also the pump. A slide coupling makes it easy to disconnect the pump from the engine and use the latter just for generating electricity or for operating other machines, with a power pulley, up to 3 hp., the engine's capacity.



PLANT AND PUMP STOP WHEN REQUIRED PRESSURE IN TANK IS REACHED

The pumping unit used may be obtained in the suction type with a capacity of 425 gal. (1608 l.) an hour, or in the deep well type having a capacity of 225 gal. (851 l.) an hour.

Transformer for Electric Bells, Door Openers, etc.

The transformer made by the Arrow Manufacturing Company of Toledo, Ohio, for operating electric bells, door openers, annunciators and heat regulators is wound with separate primary and secondary coils properly insulated and mounted in different positions on a closed ring-type laminated core. This construction, the maker points out, while more expensive than the customary kind, eliminates the danger of break-downs between windings that occur on transformers having only one coil, or where two coils are wound one on top of the other. After assembling, the windings are impregnated with a moisture proof insulating compound and then hermetically sealed in a heavy porcelain case.

The transformer, inclosed in its white-glazed porcelain case, weighs 1½ lb. (0.68 kg.) and measures 4½ by 3½ by 2 in. (11 by 9 by 5 cm.).

Commutating Pole, Low Voltage Motors and Generators

Obtaining a fixed brush position for all loads by means of commutating poles so proportioned that there is no tendency to hunt is one of the features of the motors and generators for motion picture and farm lighting service being manufactured by the Marble-Card Electric Company of Gladstone, Mich. Other features of these machines are ball bearings, short shaft lengths, good ventilation, and that the motors can be mounted in any position. These motors are furnished in either shunt or compound wound according to speed characteristics desired. The manufacturers claim that the motors and generators are absolutely free from magnetic hum and are absolutely noiseless in operation.

CAN BE USED FOR FARM-LIGHTING

The magnet frames are cast integral with supporting feet and the main poles are constructed of laminated steel punchings. The commutating pole coils placed midway between main poles are connected in series with the armature.

Equipment for Line Dead Ends

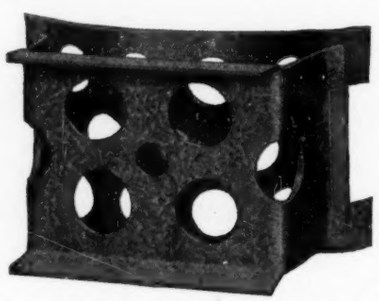
To eliminate the trouble that comes from ordinary dead end construction, the Chance Manufacturing Company, Centralia, Mo., has designed a line of brackets and crossarm back trusses which it is thought will make for more sturdy construction. The terminal brackets consist of U-shaped metal pieces which can be bolted to the face of the crossarm and which are drilled to take a slotted steel pin that holds a porcelain insulator. The design is so worked out that the entire bracket assembly can be made without the use of bolts or nuts. The back trusses for cross-arms are somewhat similar in principle to the ordinary back brace, but the manufacturer claims they are stronger and can be installed in one-fourth the time. The end castings of the truss clamp over the end of the arm and are bolted in place before the arm is raised. The truss rod in passing through the end casting, drops into a pole clamp which is bolted to the pole and is held there when the nuts are tightened.

Connection Plug for All Heating Appliances

The Redtop Electric Company, 8 West Nineteenth Street, New York City, has developed "Fitzall" plug No. 2, equipped with a spring for cord protection. This connection plug can be used with all makes of irons, stoves, toasters and other heating apparatus.

Improved Steel Gain

The steel gain, made by the Hallett Iron Works, Harvey, Ill., as it has been recently improved, consists of a pole plate and a gain plate of galvanized steel. All that is necessary to attach the gain and the arm to the pole is to place the gain on the arm and insert the through bolt. The pole plate of the gain is formed with a radius larger than that of the pole. Tightening up on the through bolt causes the struts on the gain plate to press against the pole plate. This in turn causes the pole plate to grip very tightly against the pole. When the



ATTACHMENT OF ARM TO POLE MADE EASY

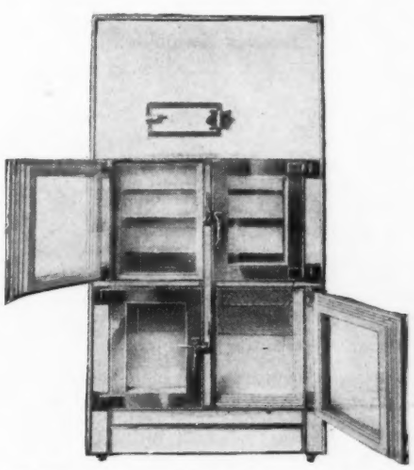
gain is used on the cross arms less than 3 ft. (1 m.) in length, the maker advocates the elimination of cross-arm braces.

Electric Urn Heater

A four point heating control switch is the feature of the model No. 28 electric urn heater which has been recently placed on the market by the Rutenber Manufacturing Company of Marion, Ind. Three heats—low, medium and full—can be obtained through its use. The heater is designed to operate under urns already installed in restaurants, cafes and hotels. The heating plate is 8¼ in. (21 cm.) in diameter and is adjustable in height from 6 to 10 in. (15 to 25 cm.). Plates can be furnished for 1000-1200 or 1500 watts with voltages of either 32, 110 or 220.

Electric Refrigerator for Domestic Use

Absence of noise, objectionable odors and exposing moving parts is one of the features pointed out by the Utility Compressor Company, 355 Harper Avenue, Detroit, Mich., in connection with its recently developed electric refrigerator. No stuffing box is used because the motor and compressor are directly connected inside an air-tight case, thereby eliminating belts and gears. In this refrigerator all the machinery is placed above the ice box proper so that four compartments are available for food storage instead of three, and in addition ice may be placed in the upper left hand compartment if desired. In this chamber, known as the "sharp freezing chamber," ice cubes for table and other use may be molded without, however affecting the temperature in other parts of the refrigerator. The thermostat which controls the temperature of the compartments may be set



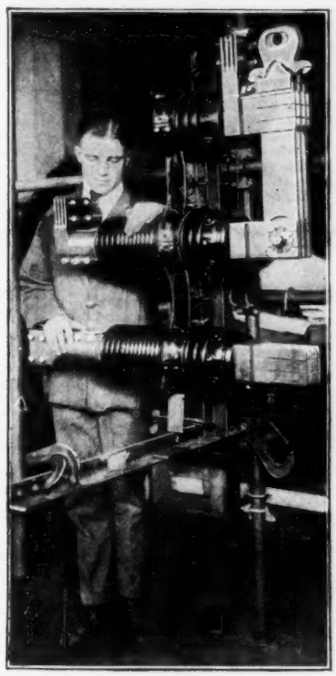
MOTOR AND COMPRESSOR IN CABINET ON TOP OF REFRIGERATOR

for any desired range. Three styles of these electric "iceless" refrigerators are available.

An "Iceless Unit"—that is the electric refrigerating machine proper—can be obtained separately for installation on top of the boxes now using ice. A hole is cut in the top of the ice chest, the cabinet placed over it, and the motor electrically connected to a source of energy.

Large Porcelain - Mounted, Back-Connected Double-Throw Switch

What is said to be the largest porcelain-mounted, back connected, double-throw switch ever built has been developed by the General Devices and Fittings Company of Chicago and is illustrated herewith, as installed in the power house of a large Middle West



SWITCH RATED AT 4000 AMP. SHOWING FORGED TERMINALS

industrial plant. The switch has a rating of 4000 amp. The forged terminals are shown in place and give some indication of the bus arrangement on this particular installation.

Improvement in Foot-Candle Meter

In order to prevent the operator of the foot-candle meter which was described in the April 19, 1919 issue of the ELECTRICAL WORLD from returning the instrument into its case without disconnecting the battery switch, a pin is now incorporated in the rheostat regulating knob. This pin projects from the knob at all times except when the switch is open. The Edison and National Lamp Works of the General Electric Company, at Harrison, N. J. and Cleveland, Ohio, and the Westinghouse Lamp Company, 165 Broadway, New York City, distribute this motor.

Electric Drink Mixer with Detachable Agitator

The No. 2 model electric drink mixer marketed by the Hamilton-Beach Manufacturing Company of Racine, Wis., is equipped with a detachable agitator, which may be removed and rinsed after serving each drink. By keeping several agitators on hand the dispenser can use a dry, sanitary obe for mixing each drink. A universal electric motor is used with the mixer and operates on voltages of 105 to 120. On top of the mixer is a card holder for a sign. A nickel-plated style with a marble base and a silver-plated mixer with an onyx base are available.

DRY AGITATOR MAY BE USED FOR EACH DRINK

NOTES ON RECENT APPLIANCES

Propeller Fan Guards

Guards in 12 to 72 in. (.3 to 1.8m.) sizes are being made by the Batterman-Truitt Company, 736 West Monroe Street, Chicago, for motor-driven propeller fans.

Pulley-Driven Blowers

The Batterman-Truitt Company, 738 West Monroe Street, Chicago, has developed a line of "uniblade" pulley driven blowers which it is selling in conjunction with electric motors for belt drive.

Spring Testing Clips

Frank W. Morse, 289 Congress Street, Boston, has placed on the market two spring testing clips, one known as No. 8 being for use with storage batteries and the other, No. 2, insulated with rubber.

Candle Stick for Christmas Tree Lighting

A Christmas tree candle stick which permits the old-fashioned candle effect to be obtained from the regular Christmas tree lighting outfit, has been brought out by C. B. Van Antwerp & Company, Chicago.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign market. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A man in Italy (No. 29,632) desires to represen' American manufacturers and exporters of electric generators, and other electrical material.

A firm in Belgium (No. 29,598) desires to purchase electric lighting equipment for a jute factory. Terms cash. Correspondence may be in English.

A commercial agent in Belgium (No. 29,730) wishes to represent American firms in the sale of electrical goods. Correspondence should be in French.

One 40-hp. Pelton wheel, 400-ft. of 8-in. piping, one 40-hp. generator, 1000 ft. of electric cable, one 40-hp. motor, electric lighting plants and storage batteries are required by a man in India (No. 29,723)

An electrical engineer in New Zealand (No. 29,724) wishes to secure prices and discounts on electric lighting, heating, and cooking appliances, also oil engines and generators for isolated lighting plants.

A commercial agent in Belgium (No. 29,586) wishes to purchase and later secure an agency for the sale of insulated cables and wires, motors and generators for direct and alternating current, transformers and various electrical material. Correspondence should be in French or Flemish.

FURTHER BRITISH ELECTRICAL IMPORT RESTRICTIONS.—The removal of import restrictions on articles additional to those published in the Electrical World of June 14 is announced by the War Trade Board as follows: Electrical toys, insulating coils and tapes (including varnished cambric and oiled silks), admitted at rate of 25 per cent of 1913 import, and carbon for arc lamps, cinemas and searchlights, admitted at 20 per cent of 1915 imports.

RADIO PLANTS ON REQUISITIONED SHIPS TO BE SOLD BY SHIPPING BOARD.—The Division of Operations of the United States Shipping Board is preparing to place upon the market the radio apparatus which it had installed on 200 requisitioned ships. The plants had been purchased from the Marconi Company and are no longer needed by the Division of Operations, as new apparatus is on hand and ready for installation on vessels that are being built for the Shipping Board. Before the war it was impossible to buy this type of apparatus, as the radio company preferred to rent rather than to sell. Bids will be received up to noon, July 15, 1919, and will then be publicly opened in the office of the supply department, division of operations, United States Shipping Board.

FRANK B. RAE, JR., has just been appointed advertising account manager for the Christian Heater Sales Company of Detroit, Mich., and is preparing new merchandising plans covering the firm's combination heaters and specialties. Factory facilities of this company have just been greatly enlarged to take care of the rapid growth of business since the closing of the war.

THE CUTLER-HAMMER MANUFACTURING COMPANY of Milwaukee, Wis., has issued $1,500,000 7% cumulative preferred stock to provide funds to retire the company's present floating indebtedness, leaving it practically without debt of any kind and placing it in a position to take care of a material increase in business which in the opinion of F. R. Bacon, president of the company, is almost certain to follow the signing of the peace treaty. The company was organized in 1893 to manufacture electrical controllers and other electrical apparatus and has had a uniformly prosperous history. Its manufacturing plants are in Milwaukee and New York City, with branch offices in New York, Pittsburgh, Boston, Philadelphia, Cleveland and Chicago.

THE ELECTRIC APPLIANCE COMPANY, Chicago, electric supply jobber, has started the publication for customers of current prices of electrical supplies.

F. D. CONKLIN, manager of the Bright Star Battery Company, 310 Hudson Street, New York City, has recently returned from service in France and has again taken up his duties with the company.

E. C. RYAN has been appointed manager of the Chicago branch of the Electric Controller & Manufacturing Company, with offices in the Monadnock, Building, Chicago. Mr. Ryan was formerly connected with the New York office.

THE RELIANCE ELECTRIC & ENGINEERING COMPANY, Cleveland, Ohio, has appointed Langdon F. Simons manager of its Boston office at 10 High Street. Ray Timmerman has been appointed Philadelphia sales manager of the same company.

THE LAPP INSULATOR COMPANY, INC., Le Roy, N. Y., announces the appointment of the following representatives: Wetmore-Savage Company, Boston, for New England; and Shield Electric Company, 149 Broadway, New York, for New York City.

THE STRUCTURAL SLATE COMPANY, of Penargyl, Pa., has recently opened branch offices in Boston, Pittsburgh, St. Louis and Chicago, which, in addition to New York City, Philadelphia, Washington, D. C., Cleveland, Columbus and Cincinnati, makes ten branch offices in all. All of these branch offices are prepared to make estimates or furnish information on the company's products.

HARRY E. DEY, Inc., is the name of a company recently incorporated for the purpose of taking up the manufacture of the Dey electric automobile, which created a sensation some time ago when the New York Times came out with a long interview with Dr. Charles P. Steinmetz, in which he made a statement that Mr. Dey has solved the problem of the five-hundred-dollar electric automobile. Mr. Dey has bought out the other interests and is now engaged in raising necessary capital to begin manufacture of the car. A temporary office of the new company is at 303 Arlington Avenue, Jersey City, N. J.

THE NATIONAL TUBE COMPANY, Pittsburgh, Pa., announces that it has made arrangements with the National Metal Molding Company of Pittsburgh and the American Circular Loom Company of New York to act as its distributor of spellerized mild-steel tubing, made especially for the manufacture of rigid-steel conduits. These two companies will, as heretofore, finish and market this tubing under the following trade names: National Metal Molding Company, "Sherarduct," sherardized rigid-steel conduit, and "Economy," black-enameled rigid-steel conduit; American Circular Loom Company, "Xduct," galvanized rigid-steel conduit, and "Electroduct," black-enameled rigid-steel conduit. The companies named, it is stated, will probably take the entire output of National conduit pipe.

THE EDWARD N. RIDDLE COMPANY, is the new name for the Western Gas Fixture Company. This in no way changes the personnel or policies of the company but merely eliminates the somewhat detrimental words "gas fixture." The present officers of the company remain the same, namely, Edward N. Riddle, president; J. N. Riddle, vice-president, and J. K. Riddle, secretary. This company has opened a new display room at 292 Fifth Avenue, New York City, within the past week or two and has appointed the Crucet Manufacturing Company of New York City its Eastern selling agents to operate this display. The Crucet company will have men travel the Atlantic Coast and New England territory for the purpose of marketing the new Riddle line of portable lamps, shades and decorative novelties, as well as the complete line of lighting fixtures. The company has also arranged to display its lamps, shades and novelties at Grand Rapids, Mich., on the second floor of the Keeler Building during the furniture seasons of July and January. Plans have been laid to more than double the company's factory production this year in order to take care of the increased business resulting from increased sales efforts. New price list is being published which will readjust to a peace-time basis the prices covered in No. 14 and 15 catalogs.

Trade Publications

TWO-WAY PLUGS.—The Benjamin Electric Manufacturing Company of Chicago has prepared two street-car cards and a wall hanger, to advertise the Benjamin Two-Way plug.

SILICA SAND. — The Commonwealth Silica Company of Ottawa, Ill. has published an attractively printed illustrated brochure on Buffalo rock silica sand for steel foundry use.

POTENTIAL TRANSFORMER.—Its new potential transformer, dry insulated, is illustrated and described in bulletin No. 415-30 from the Condit Electrical Manufacturing Company of South Boston, Mass.

STORAGE BATTERIES.—A leaflet on storage battery trucks and tractors and Edison storage batteries is being circulated by the Edison Storage Battery Company, 840 Lakeside Avenue, Orange, N. J.

DIRECT CURRENT MOTORS AND GENERATORS. — The Allis-Chalmers Manufacturing Company of Milwaukee has published an 18-page bulletin No. 1096-A. on direct current motors and generators.

LIGHTING UNITS.—Two catalogs have just been issued by the Art Metal Manufacturing Company of Cleveland. One Catalog is devoted entirely to commercial and industrial lighting units, the other to residential lighting fixtures.

ELECTRICAL SUPPLIES.—The Canton Engineering & Electric Company of Canton, Ohio, has issued catalog No. 18, a cloth-bound 635-page book illustrating and describing electrical supplies, motors, machinery, fixtures, lighting specialties and storage batteries.

ELECTRIC RANGES.—"Better Canning Electrically on the Hughes Range" is the title of an illustrated folder which has been issued by the Hughes Division, Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, giving directions for canning various foods.

New Incorporations

THE ESSEX AUTO ELECTRIC SERVICE, INC., of Newark, N. J., has been incorporated by Gottlieb Jacobs, and Philip Lowits. The company is capitalized at $100,000 and proposes to manufacture electrical appliances.

THE SCHIEFER ELECTRIC COMPANY of Rochester, N. Y., has been incorporated by H. J. and F. L. Schiefer, Ellwanger & Barry Building, Rochester. The company is capitalized at $75,000 and proposes to manufacture electrical equipment.

THE AMERICAN LAMP & SPECIALTY COMPANY of Evansville, Ind., has been incorporated by James H. Powers, Patrick Hughes and Charles Martin. The company is capitalized at $25,000 and proposes to manufacture lamps and specialties.

THE CARPARTS COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of $40,000 to manufacture electric and steam railroad car equipment. The incorporators are: W. and F. X. Senftle, 129 College Street, and H. P. Miller, 310 Ideal Street, Buffalo.

THE HARTFORD (CONN.) STORAGE BATTERY COMPANY has been chartered with a capital stock of $50,000 by Roy J. Bessette, Bellani Tromble of Hartford, and Stanley W. Edwards of Granby. The company proposes to manufacture storage batteries and to operate a repair plant.

THE UNIVERSAL ELECTRIC FURNACE COMPANY, 1520 Fidelity Building, Baltimore, Md., has been incorporated by Raymond M. Glacken, Frederick E. Fisher and Robert E. Kanode. The company is capitalized at $20,000 and proposes to manufacture electric furnaces, reclamation plants, foundry machinery, etc.

THE FRANCIS VAUGHN MANUFACTURING COMPANY of Milwaukee, Wis., has been chartered with a capital stock of $50,000 to manufacture electrical instruments and appliances and other devices. Francis Vaughn, 271 Thirty-first Street, electrical engineer and director of School of Engineering, is interested in the company.

New England States

CASTLETON, VT.—The Rutland Railway, Light & Power Company is erecting a substation near Castleton to supply electricity to the various manufacturing plants in western Vermont. Two transformers capable of handling 3000 hp. will be installed. Provision has been made for the installation of a third transformer in the future.

BOSTON, MASS.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 15 for furnishing switchboard panels at the Boston Navy Yard, under schedule 4177.

FITCHBURG, MASS.—The New England Power Company is contemplating improvements to its local substation, on Beech Street, to cost about $10,000. New equipment will be installed.

SOUTHWICK, MASS.—The installation of an electric lighting system in Southwick is under consideration.

WEBSTER, MASS.—The Webster-Dudley Chamber of Commerce is considering the installation of an ornamental street-lighting system on Main Street in Webster and Dudley.

WORCESTER, MASS.—The committee on street lighting of the City Council is considering plans for extensions to the street-lighting system on several streets in the city.

HARTFORD, CONN.—The Hartford Electric Light Company is planning to build a new machine shop and auto service plant for its trucks and cars on Sheldon Street, to cost about $34,000.

Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has petitioned the Federal Court for permission to purchase the power house at Kent and Division Avenues, Williamsburg, owned by the Brooklyn City Railroad Company, for about $225,000.

BUFFALO, N. Y.—A permit has been taken out by the Robertson-Cataract Electric Company for the erection of a six-story building at its plant at South Elmwood Avenue and Niagara Street, to cost about $80,000.

COHOES, N. Y.—A petition, signed by the Crystal Bleaching Company, the Peterson & Packer Coal Company, Cohoes Manufacturing Company, the W. W. Synder Manufacturing Company and the Mohawk Gas Company, has been presented to the City Council asking that the Cohoes Power & Light Corporation be granted permission to erect transmission lines to the East Side to supply electricity to the various manufacturing plants in that section of the city.

HORNELL, N. Y.—Plans are under consideration by the Hornell Electric Company for improvements to the street-lighting system.

MALONE, N. Y.—Bids will be received by Edward S. Walsh, Superintendent of Public Works, Capitol, Albany, until July 17 for construction, including heating, sanitary and electric work, of addition to State armory in Malone.

OSWEGO, N. Y.—The City Council has engaged an engineer to prepare plans for the construction of a steam-driven municipal electric light plant.

SOLVAY, N. Y.—Contract has been awarded by the Board of Trustees to F. L. Worth, 430 Center Street, for the construction of a substation to be used in connection with the municipal electric service.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of board of managers of Letchworth Village, 7 Wall Street, New York, N. Y., until July 17 for construction, including heating, sanitary and electric work, of service building and eight cottages for girls' group, and industrial building for boys' group; construction of underground tunnel and conduit, underground hot water and steam connections and distributing equipment, underground sewer and water connections and underground electric service connections for girls' group at Letchworth Village. Drawings and specification may be obtained at the Department of Architecture, Capitol, Albany. L. F. Pilcher is state architect.

UTICA, N. Y.—Plans are being prepared by the Langdon & Hughes Electric Company, 233 Elizabeth Street, for the erection of a new building at 225-229 Elizabeth Street, to cost between $60,000 and $70,000.

UTICA, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 29 for construction, including heating, sanitary and electric work, of building for chronic patients (male); building for chronic patients, (female); building for acute patients at the Utica State Hospital (Marcy Division), Utica. L. F. Pilcher is state architect.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MONTCLAIR, N. J.—Bids will be received by the secretary of board of education, of the town of Montclair, until July 8 for alterations to the Watchung School, including general construction plumbing, heating and ventilating and electrical work. Separate bids to be submitted for each division of the work. Drawings and specifications may be obtained from Starrett and Van Vleck, architects, 8 West Fortieth Street, New York, N. Y., upon deposit of $10. Plans may be seen at the office of the board of education, 22 Valley Road, Montclair.

POMPTON LAKES, N. J.—Preparations are being made by the Tri-County Electric Company for the erection of an electric transmission line through Pequannock Township and in the Riverside section. The company has been granted a franchise by the Pequannock Township.

MAUCH CHUNK, PA.—Allentown capitalists, it is reported, are interested in the organization of a new electric light company in this township.

PORT ALLEGANY, PA.—The Borough Council is considering the installation of a municipal electric light plant in Port Allegany.

READING, PA.—The Metropolitan Edison Company of Reading has entered into a contract with the York Haven (Pa.) Water Power Company for an exchange of electric energy.

WASHINGTON, D. C.—In the revision of the House naval appropriation bill the Senate naval affairs committee has added the following items: For the Philadelphia Navy Yard, general development, $1,000,000; power plant, $500,000; light machine shop $400,000; pattern shop, $400,000. Norfolk Navy Yard, machine and electrical shops, $40,000; pattern shop, $400,000. Boston Navy Yard, power plant, $100,000.

WASHINGTON, D. C.—Bids will be received at the Army Construction Division, Washington, D. C., until July 8, under proposal 150, for fire-alarm equipment to be installed at Camp Bennings. Bids will also be received at the same place and date by John C. Greenberg, under proposal 153, for fire alarm apparatus for Philadelphia quartermaster terminal. Further information may be obtained from Captain G. H. Litchfield, at the above office.

North Central States

ADRIAN, MICH.—The United Electric Manufacturing Company is planning to erect a one-story building, to cost between $75,000 and $100,000.

KALAMAZOO, MICH.—Extensions are contemplated by the Western Board & Paper Company including the erection of a new building, 60 ft. by 218 ft., Automatic stokers and a mechanical coal conveyor will be installed in the power plant. A. E. Curtenius is president.

MOUNT PLEASANT, MICH.—Contract has been awarded by the Transport Truck Company for the erection of its proposed new plant, consisting of a manufacturing building, power plant and office building, to A. W. Stollman, East Armory Street, Champaign, Ill. The cost is estimated at $100,000.

DAYTON, OHIO.—The Dayton & Power Company has acquired a site at Fouth Avenue and Conover Street on which it proposes to erect a substation to serve that section of the city, including Edgemeont, West Side and Dayton View. Definite plans have not yet been decided upon.

MARYSVILLE, OHIO.—The Marysville Light & Water Company is contemplating the erection of 28 miles of transmission lines. Mayne Mackan is superintendent.

OBERLIN, OHIO.—Bonds to the amount of $50,000 for the installation of a municipal electric light were authorized by the voters at an election held May 27. F. B. Spelbrink has asked City Solicitor Hammond to bring an injunction against the city to prevent the sale of the bonds.

TOLEDO, OHIO.—The Toledo Factories Building Company is considering an addition to its present building, to cost about $100,000.

LUDLOW, KY.—The Pullman Company of Chicago, Ill., is planning to rebuild its car repair shops near Ludlow, recently destroyed by fire. The loss is placed at $100,000.

FORT WAYNE, IND.—Extensive improvements will be made to local exchange of the Home Telephone & Telegraph Company, including the installation of new switchboard equipment, etc.

INDIANAPOLIS, IND. — The Home Elevator Company is planning to erect a new building, 100 ft. by 150 ft., to cost about $20,000. An electric crane to cost $20,000 additional will be installed.

PERU, IND.—Plans have been prepared for extensive improveemnts to the local yards of the Lake Erie & Western Railroad Company, including the erection of a new power house, mill, machine shops and ten additional stalls for the recently constructed roundhouse. The cost of the work is estimated at about $250,000.

CHICAGO, ILL.—The Ilg Electric Ventilating Company is erecting a plant at the corner of Crawford Avenue and South George Street. The company manufactures fans and blowers.

CHICAGO, ILL.—The Cole Storage Battery Company has taken over the property at 2435-39 Indiana Avenue. The present building, it is understood, will be remodeled and used for a storage-battery manufacturing plant. Isadore B. Freed is interested in the battery company.

DES PLAINES, ILL.—Bids are being asked by the Benjamin Electric Company for the erection of a new plant, 66 ft. by 286 ft., three stories, to cost about $200,000.

ELIZABETHTOWN, ILL.—Steps have been taken to organize a company to construct and operate an electric light plant in Elizabethtown. A franchise, it is understood, has been granted.

MADISON, ILL.—Plans are being prepared by the Barber Asphalt Paving Company, Land Title Building, Philadelphia, Pa., it is reported, for the erection of a new refining plant at its local works, to cost, with equipment, about $400,000.

MOLINE, ILL.—Contract has been awarded to the Henry W. Horst Company for the construction of a foundry for the Moline Plow Company in East Moline. The building will be 120 ft. by 400 ft. and will cost about $250,000.

ORION, ILL.—The erection of a high-tension electric transmission line from Coal Valley to Milan is under consideration by the Sherrard power system.

SOUTH PEKIN, ILL.—The village of South Pekin is considering granting a franchise for the installation of an electric lighting system. The village Board has also decided to ask the Tazewell County Supervisors to assist in the connection for part of the distance.

SPRINGFIELD, ILL.—The installation of a new ornamental lighting system is under consideration by the city council.

BELOIT, WIS.—Owing to the installation in the near future of a new central bridge, the City Council has granted the street-lighting committee permission to redraft plans for the proposed new ornamental street-lighting system in the business section of the city.

JANESVILLE, WIS.—The Parker Pen Company has awarded general contract for the construction of its proposed factory and power house to the Rauif Company, Patton Building, Milwaukee. The cost of the plant complete is estimated at $300,000. Frank A. Carpenter of Rockford, Ill., is architect.

MANITOWOC, WIS.—The City Commissioners are contemplating the installation of an electric street-lighting system on South Eighth Street.

ELY, MINN.—An election will be called to submit to the voters the proposal to issue $60,000 in water and light bonds.

HINCKLEY, MINN.—Bonds to the amount of $30,000 have been voted for the construction of an electric light plant.

GLYNDON, MINN.—An election will soon be called to vote on the proposal to issue $10,000 in bonds for the purchase and the extension of the electric plant of the Glyndon Light Company. If the proposition carries, it is proposed to erect an electric transmission line to connect with the extension of the Union Light, Heat & Power Company at Dilworth. The plans also provide for a twenty-four hour service.

WELLS, MINN.—Bids will be received by the Water, Light, Power and Building Commission of Wells until July 10 for costruction of municipal power plant, including concrete reservoir, power house and equipment. Plans and specifications may be obtained at the office of the Charles L. Pillsbury Company, engineer, Metropolitan Building, Minneapolis, upon deposit of $10 of which $7.50 will be refunded upon return of plans.

CENTERVILLE, IOWA — The Iowa Southern Utilties Company is contemplating remodeling its power house in Centerville.

CARUTHERSVILLE, MO. — The City Council has engaged Black & Veatch, Interstate Building, Kansas City, Mo., to prepare plans for extensions and improvements to the municipal electric light plant and water works system.

FULTON, MO.—The City Council is considering calling an election to submit to the voters the proposal to issue $50,000 in bonds to build a municipal telephone exchange.

CHURCH'S FERRY, N. D.—Bids will be received by the village of Church's Ferry until July 11 for construction of an electric lighting system as follows: (1) For construction of power house; (2) For furnishing and installing two oil engnes, necessary piping and accesories, two three-phase, 60-cycle, 2300-volt alternators with exciters, switchboard, etc., and furnishing and erecting poles, wires, street lamps, transformers, etc., for the electrical distribution system. Bids will be received on complete parts only. Plans and specifications may be obtained at the office of H. A. Moe, village clerk, Church's Ferry, or at the office of Earle D. Jackson, consulting engineer, St. Paul, Minn., for which a charge of $3 will be made to cover the cost of printing.

EMERSON, NEB.—Bonds to the amount of $20,000 have been voted for the installation of a municipal electric light plant.

KANSAS CITY, KAN.—Bonds to the amount of $500,000 have been voted for extensions to the municipal electric power plant. The proposed improvements include extension to the main power plant at Quindaro and the erection of a substation near Tenth Street and Muncie Boulevard, to supply electrical service in the southern part of the city.

ST. JOHN, KAN.—Bonds to the amount of $50,000 have been voted for improvements to the municipal electric light plant and water works system. Burns & McDonald, Interstate Building, Kansas City, Mo., are engineers.

SHARON SPRINGS, KAN.—Bonds to the amount of $50,000 have been voted for improvements to water works system, including the erection of a 75,000-gal. tower and tank, and also construction of power house and the installation of two engines, one 100 hp. and the other 150 hp.

WICHITA, KAN.—Plans have been prepared by the Kansas Gas & Electric Company for extensions and improvements to its local system, to cost about $500,000., which will include the erection of a new building and the installation of an additional 10,000-kw. steam turbine. The company is also contemplating the erection of an electric transmission line running from the present transmission system between Wichita and Augusta to Arkansas City. The proposed line will connect the company's three plants at Newton, Arkansas City and Wichita, insuring a much better service through entire length of the territory now served in the Arkansas Valley. The extension of a transmission line into the Elbing-Peabody oil field is also under consideration. The cost of the entire work is estimated at about $1,500,000.

Southern States

FAYETTEVILLE, N. C.—The Cumberland Railway & Power Company is planning to install additional electrical equipment in its substation to furnish electricity between Fayetteville and Camp Bragg.

TAYLORSVILLE, N. C.—The Town Commissioners have granted a franchise to T. C. Alspaugh and R. L. Alspaugh to furnish electricity for lamps and motors in Taylorsville. The Alspaugh Light & Power Company will build a hydroelectric plant, to cost about $30,000, about 6 miles from the town. Bids, it is understood, have been received for construction of the proposed plant.

ALBANY, GA.—The Georgia-Alabama Power Company, it is reported, has purchased the Creddle property on Catawba Creek, near Fort Gaines, for an additional power site, which will be developed in the near future. The company has recently closed contracts to supply electricity in Eufaula and Enterprise, Ala.

ARLINGTON, GA.—The Baker County Power Company, it is reported, is planning to construct a hydroelectric power plant on Natchanny Creek.

MONTGOMERY, ALA.—The City Commission has granted the Montgomery Light & Traction Company permission to extend its line on Bell Street to the Aviation Depot.

NEW ALBANY, MISS.—The transmission lines of the municipal electric light plant has been completed to a sururban community, 2¼ miles north of the town. Other lines, it is reported, will be extended in other directions to similar communities.

CLARKSVILLE, ARK.—The Commonwealth Public Service Corporation, which supplies electricity to all towns between Van Buren and Clarksville and also to several coal mines in Franklin and Johnson Counties, is planning to erect a large central power plant in Johnson County in the vicinity of Clarksville, to cost about $200,000. Steam turbine will be used to drive the proposed plant. The company now purchases power for distribution.

NEW ORLEANS, LA.—The Navy Department, Washington, D. C., is planning to install a power plant at the local navy yard, to cost about $200,000, and to expend $100,000 for a coaling wharf plant.

BEGGS, OKLA.—The Beggs Power & Ice Company is planning to construct an electric light plant, to cost about $100,000.

OKEMAH, OKLA.—An election will soon be called to submit to the voters the proposal to issue $50,000 in bonds for extensions and improvements to the municipal electric light plant and $23,000 for improvements to the municipal waterworks system.

MEXIA, TEX.—A new electric power plant is being installed in Mexia, at a cost of about $150,000. When completed the plant will supply electricity in the towns of Thornton, Coolidge and Croesbeck as well as Mexia. Machinery, it is understood, has been purchased.

Pacific and Mountain States

SEATTLE, WASH.—The City Council has appropriated $14,000 for completing the Ballard and Yesler Way substations.

SEATTLE, WASH.—Permanent development of city's Cedar River hydroelectric power plant, to cost about $420,000, has been authorized by the utilities committee of the City Council. The work will consist of the installation of an additional 10,000-kw. generating unit, an addition to the present power house, to cost about $280,000, and the erection of a transmission line, to cost about $150,000. An ordinance already passed provides for the construction of a penstock, 7200 ft. long, from the present masonry dam to the power plant at Cedar Falls, at a cost of about $195,000. The utility committee is also considering the installation of a 14,000-kw. unit at the Lake Union steam power plant, recommended by J. D. Ross, superintendent of the municipal lighting department.

YAKIMA, WASH.—Arrangements, it is reported, have been made whereby the Pacific Light & Power Company will make connections with the high-tension transmission line of the Montana Power Company, extending from near Billings, Mont., to Seattle, at Lind.

BEND, ORE.—The Bend Water, Light & Power Company has begun preliminary engineering work on its proposed electric power plant on Tumalo Creek. The plant will have a generating capacity of about 1800 hp. and will cost about $125,000. T. H. Foley is manager.

ROSEBURG, ORE.—The Roseburg Light & Power Company is planning improvements to its power and pumping plant on the North Umpqua River and putting its entire system in condition to meet the increasing demands for electrical service. William Pollman is president.

AVALON, CAL.—Bonds to the amount of $88,000 have been voted for the construction of an electric light plant and water works system, and $55,000 for a gas plant. A. B. Waddingham, Tajo Building, Los Angeles, is engineer.

CALEXICO, CAL.—At an election held recently the proposal to issue $325,000 in bonds to establish electric light and gas plants was defeated.

CALIFORNIA CITY, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning the installation of a new electric power plant at the local coaling station. The work will be in charge of the officials at Mare Island Navy Yard, Vallejo.

FULLERTON, CAL.—The installation of an ornamental street lighting system in the business and the semi-business sections has been recommended by the Board of Trade. The proposed system would require 210 posts and would cost about $47,000. In the business district lamps of 250 cp. would be used and in the semi-business districts lamps of 100 cp. Designs for lamp posts have been called for.

GREENVILLE, CAL.—The substation of the Great Western Power Company at Nevis dam was recently destroyed by fire. The plant will be rebuilt as soon as possible.

LOS ANGELES, CAL.—The Board of Public Utilities has instructed the Los Angeles Railway Corporation to prepare for double-tracking its line on new Broadway between Tenth and Pico Streets.

MAYFIELD, CAL.—The Board of Town Trustees has decided either to acquire the local distribution system of the Pacific Gas & Electric Company or to build a new system, to be owned and operated by the municipality.

SALT LAKE CITY, UTAH.—The Secretary of Agriculture has given his approval for the construction of a large power plant on the Duchesne River in Utah by the Great Basin Power Company. The proposed plant will develop from 8000 hp. to 19,000 hp. and when completed will supply electricity to the Duchesne Valley and Salt Lake City.

MESA, ARIZ.—At an election to be held July the proposal to issue $35,000 in bonds for extensions to the municipal electric light system will be submitted to the voters.

BUTTE, MONT.—The Montana Power Company is planning to extend its transmission lines to the east central agricultural belt of Montana. The Montana Company will take over the plant of the Roundup Electric Company. The mining properties of the Republic and Roundup Coal Mining Companies, it is understood, will be equipped for electrical operation. Energy will be supplied by either the Great Falls power station or the Madison River plant, near Bozeman. The cost of the proposed work will be about $500,000.

ELKO, NEV.—Arrangements are under way to establish a model village for the Indians, equipped with electric lights, city water, etc., and both a grammar and a high school.

FALLON, NEV.—The Nevada Valley Power Company of Lovelocks has petitioned the County Commissioners for a fifty-year franchise to erect and operate electric transmission lines in Churchill County. The company is planning to erect a large electric plant on the Truckee River. The company now supplies electricity in Fallon. It also proposes to renew the lease held by the company of the government hydroelectric plant at Lahontan dam, provided the federal officials will extend the agreement.

Canada

MARYSVILLE, N. B.—The installation of a new street-lighting system in Marysville is under consideration.

BARRINGTON, N. S.—A new company, it is reported, has been organized to develop a water power on Barrington River and to supply electricity to several villages.

COBALT, ONT.—The Northern Ontario Light & Power Company is planning to erect a substation at Boston Creek, to cost about $7,000.

PARRY SOUND, ONT.—Contracts will soon be awarded for construction of a hydroelectric power plant for the township of Parry Sound. The proposed work will include power dam, intake, conduit, generating station and tailrace, mill lake dam, hydraulic and electrical equipment. C. H. and P. H. Mitchell, Bank of Hamilton Building, Toronto, are engineers. J. D. Broughton is clerk and treasurer.

SAULT STE. MARIE, ONT.—The Great Lakes Power Company, it is reported is contemplating the construction of a new hydroelectric power plant at Michipicten Falls, to cost about $1,000,000. Part of the power generated will be used to operate the White River division of the Canadian Pacific Railway.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario is planning to construct a power plant and a 200-ft. concrete dam, 43 ft. high, at Cameron Pool. The proposed plant will have an output of about 60,000 hp.

TRAFALGAR, ONT.—The township of Trafalgar has decided to install an electric lighting system, to cost about $6,000.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

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ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Chicago, Oct. 20-23.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

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NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 22, 23, 24.

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NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

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RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 4171 Beaufort Avenue, Woodlawn, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

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SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual convention, Asheville, N. C., Sept. 17-19.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

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WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

Issued June 3, 1919

1,305,950. ELECTRIC CONTROLLER; Harry F. Stratton, Cleveland, Ohio. App. filed Oct. 23, 1917. Automatically actuated.

1,305,951. ELECTRIC CONTROLLER; Harry F. Stratton, Cleveland, Ohio. App. filed Dec. 7, 1917. For accelerating motors.

1,305,956. SIGNALING DEVICE; John W. White, Brooklyn, N. Y. App. filed Jan. 25, 1917.

1,305,970. CAR-LIGHTING SYSTEM; Patrick Kennedy, Brooklyn, N. Y. App. filed Dec. 1, 1916.

1,305,981. TELEPHONE SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed May 22, 1917.

(Issued June 10, 1919)

1,306,555. ELECTROMAGNETIC SWITCH; Edwin J. Murphy, Schenectady, N. Y. App. filed April 29, 1916. Motor may be started and automatically brought up to running speed.

1,306,556. SYSTEM OF LOAD DISTRIBUTION FOR SYNCHRONOUS-TYPE FREQUENCY CHANGERS; Frank D. Newbury, Pittsburgh, Pa. App. filed May 13, 1918. Respond promptly, and effective in their load distribution to relatively small changes in field strength.

1,306,559. INCLOSED-ARC DEVICE; John A. Orange, Schenectady, N. Y. App. filed March 6, 1916. Automatic means for starting the arc without using high-potential devices.

1,306,566. TROLLEY-CONDUCTOR DEVICE; Nils I. A. Wahlberg, Pittsburgh, Pa. App. filed July 10, 1918.

1,306,570. ELECTRICAL APPARATUS; James Wilkinson, Pittsfield, Mass. App. filed Dec. 28, 1915. Chamber changes in dimensions as oil expands.

1,306,593. SIGNALING SYSTEM FOR TRANSMITTING INFORMATION FROM A SENDING STATION TO ONE OR MORE RECEIVING STATIONS; John L. Hall, Schenectady, N. Y. App. filed Aug. 28, 1918.

1,306,594. DOUBLE-RANGE REGULATING SET FOR CONTROLLING SPEED OF INDUCTION MOTORS; John I. Hull, Schenectady, N. Y. App. filed Aug. 8, 1916. Excitation reduces slip.

1,306,624. ELECTRICAL MEASURING INSTRUMENT; Willard E. Porter and Alvarado L. R. Ellis, Lynn, Mass. App. filed Nov. 12, 1917. Moving element is positioned in a substantially spherical air gap.

1,306,625. DYNAMO-ELECTRIC MACHINE; Edward D. Priest, Schenectady, N. Y. App. filed June 1, 1917. Method of twisting coil ends.

1,306,631. RECORDING DEVICE; Robert H. Rogers, Schenectady, N. Y. App. filed Aug. 14, 1916.

1,306,638. CIRCUIT-CONTROLLING DEVICE; Robert S. Shaw, Port Hope, Ontario, Can. App. filed March 16, 1918. Circuit automatically broken on overloads.

1,306,667. VACUUM-OPERATED MAKE-AND BREAK SPARK PLUG; Herbert G. Irwin, Spur, Tex. App. filed Sept. 11, 1917.

1,306,670. INSULATING SUPPORT; Samuel H. Lanyon, Oakland, Cal. App. filed June 12, 1916. Does not use cement.

1,306,672. ELECTRIC PULL SWITCH; Earl H. Van Loon, New York, N. Y. App. filed June 23, 1917. Has projecting arm for chain attachment.

(Issued June 17, 1919)

1,306,716. SELECTIVE SIGNALING SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed Aug. 23, 1916.

1,306,718. SEAM DETECTOR FOR FABRICS OR THE LIKE; Franklin A. Papineau, Webster, Mass. App. filed Dec. 14, 1918. Notice is given to an operator.

1,306,723. AUTOMATIC SWITCH FOR FLATIRON; Frank A. Schultz, Chicago, Ill. App. filed March 17, 1917. To facilitate heat control.

1,306,740. FLASHLIGHT; Hyman Bieber, Liverpool, Eng. App. filed Aug. 9, 1917.

1,306,746. WELDING TOOL; John J. Campbell, Brooklyn, N. Y. App. filed Jan. 29, 1919. Grips electrode firmly.

1,306,763. STAND FOR SEWING MACHINES; Leo. C. Kiehnle, Elizabeth, N. J. App. filed Sept. 21, 1918. Change from electrical to foot-power operation.

1,306,770. SWITCH-OPERATING MECHANISM; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Oct. 30, 1915. Ready release of the locking mechanism.

1,306,784. ELECTROMAGNETIC CLUTCH; Alfred Soames and Walter Langdon-Davies, London, Eng. App. filed Oct. 30, 1918. No variable air gap.

1,306,791. TIMER FOR ENGINES; Leo H. Whelan, Youngstown, Ohio. App. filed Jan. 3, 1919.

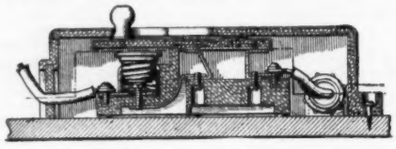
1,306,804. TELEPHONE SYSTEM HAVING INSTANTANEOUS DISCONNECT AND RECALL; Hiram D. Currier, Chicago, Ill. App. filed Sept. 19, 1914.

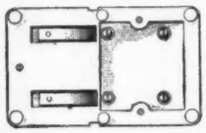
1,306,815. COIL; Alfred W. Houchin and Charles E. Luburg, Kirkwood, N. J. App. filed April 30, 1917.

1,306,824. SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Fritz Lubberger, Chicago, Ill. App. filed June 16, 1910.

1,306,825. TELEPHONE DISTRICT EXCHANGE SYSTEM; Bernard D. Willis and Talbot G. Martin, Chicago, Ill. App. filed Aug. 11, 1913.

1,306,826. SEMI-AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed July 7, 1913.





1,305,998—Electric Switch Device

1,306,827. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed Feb. 26, 1914.

1,306,829. AUTOMATIC TELEPHONE SYSTEM; Edward A. Mellinger, Chicago, Ill. App. filed Feb. 17, 1913.

1,306,844. SPARK INDICATOR; Homer Anderson, Peekskill, N. Y. App. filed Aug. 9, 1915.

1,306,852. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed June 8, 1911. Battery.

1,306,854. ELECTRICAL REGULATOR; Charles E. Marks, New York, N. Y. App. filed Sept. 27, 1918. Protective means for limiting the field excitation of a generator.

1,306,874. ELECTROMAGNETIC SWITCH; Paul H. Zimmer, Milwaukee, Wis. App. filed April 23, 1914. Mechanically locked in attracted position.

1,306,878. ELECTRICAL REGULATOR; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 5, 1916. Rapidly opens and closes a circuit in shunt to a resistor.

1,306,885. ELECTRIC MULTIPLE SWITCH; Arthur E. Francis, Cleveland, Ohio. App. filed Oct. 10, 1917.

1,306,894. SYSTEM OF REGULATION; Frederic C. Hanker, Wilkinsburg, Pa. App. filed May 4, 1916. Control the field strengths of dynamo-electric machines.

1,306,897. MOTOR CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed Feb. 4, 1916. Lockout switch.

1,306,912. ELECTRIC LAMP; Frederick G. Keyes, Hoboken, N. J. App. filed Jan. 8, 1914. Larger-diameter tungsten filament.

1,306,923. ELECTRIC CURRENT-CHANGING MEANS; Clyde J. Myers, Indianapolis, Ind. App. filed April 4, 1918. Direct-current dynamo.

1,306,942. EXTRACTION OF LEAD; Edward S. Berglund, Trollhättan, Sweden. App. filed March 11, 1918.

1,306,948. ELECTRIC FURNACE; Monroe S. Clawson, Weehawken, N. J. App. filed Feb. 21, 1917. Easy discharge for melted metal.

1,306,959. ELECTRIC WELDING MACHINE; Giulio Gandolfo, Sampierdarena, Italy. App. filed Feb. 28, 1918. Jaws are readily removable.

1,306,985. ELECTRICALLY OPERATED INK RECORDER; Lloyd Williams, Cadishead, near Manchester, Eng. App. filed April 15, 1919.

1,307,006. ELECTRIC SWITCH; Harold P. Hastings, Syracuse, N. Y. App. filed Sept. 19, 1914. Push.

1,307,019. PANELBOARD; Edwin A. Olley, Syracuse, N. Y. App. filed July 16, 1915. Safe and compact.

1,307,028. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; Burton W. Sweet, Cleveland, Ohio. App. filed Aug. 7, 1915. Multipolar.

1,307,030. ELECTRIC WELDING SYSTEM; David H. Wilson, Paterson, N. J. App. filed Dec. 31, 1914. Resistance normally in the circuit.

1,307,038. AUTOMOBILE SIGNAL; Baxter H. Bruce, United States Navy. App. filed Jan. 17, 1916.

1,307,048. ELECTRIC RANGE; Frank W. Hewitt, Arlington, Mass. App. filed Dec. 30, 1918. Fittings assembled in distributing box.

1,307,057. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Dec. 29, 1916.

1,307,070. DISSIPATING HEAT FROM UNDERGROUND CONDUITS; George F. Wennagel, Baltimore, Md. App. filed Aug. 11, 1916. Artificial introduction of cooling water.

1,307,086. THERMAL CIRCUIT CLOSER; Richard Dijkstra, Chicago, Ill. App. filed Nov. 9, 1918.

1,307,093. ELECTRIC INDUCTANCE APPARATUS; Benjamin F. Gardner, Chicago, Ill. App. filed Aug. 26, 1918. For electromedical service.

1,307,094. ELECTRIC SWITCH; Alfred C. Gilbert, New Haven, Conn. App. filed Jan. 28, 1918. Toy electric motor.

1,307,099. VARIABLE-SPEED DYNAMO-ELECTRIC MACHINE; Albert H. Midgley, Acton Vale, Eng. App. filed Nov. 23, 1915. Motor cars.

1,307,100. CIRCUIT CLOSER FOR SIGNAL DEVICES; Patrick F. Morris, Butte, Mont. App. filed May 12, 1917. For mine cages.

1,307,102. GALVANIC BATTERY; John E. Preston, London, Eng. App. filed Dec. 30, 1916.

1,307,155. ANTENNA CONSTRUCTION FOR AERIAL VESSELS; Adolph W. Schramm, Riverton, N. J. App. filed April 9, 1918.

1,307,177. ENGINE-STARTING APPARATUS; Joseph Bijur, New York, N. Y. App. filed June 25, 1913.

1,307,178. ENGINE-STARTING APPARATUS; Joseph Bijur, New York, N. Y. App. filed May 5, 1913.

1,307,189. FLOAT-CONTROLLED SWITCH; Louis W. Downes and Walter S. Mayer, Providence, R. I. App. filed June 29, 1915. For controlling [illegible] a motor.

1,307,196. AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEM; Oscar Grahn, London, Eng. App. filed March 20, 1917.

1,307,198. ELECTRIC HEATER; August Harth, Chatham, N. J. App. filed June 4, 1913. No riveted points.

1,307,230. CHANGE-SPEED GEARING; Thorsten von Zweigbergk, Lancaster, Eng. App. filed Nov. 1, 1915.

1,307,258. ELECTRIC SWITCH; Andrew L. Johnston, Jr., Richmond, Va. App. filed April 2, 1918. Easy inspection and refusing.

1,307,286. CIRCUIT CLOSER; Richard A. Wesolek, Toledo, Ohio. App. filed Nov. 5, 1918.

1,307,300. ALARM DEVICE; Willis E. Langenberg, Milwaukee, Wis. App. filed May 27, 1918.

1,307,305. ELECTRICALLY OPERATED SIGNAL FOR MAIL BOXES; Harvey R. Newquist, Wausau, Neb. App. filed April 20, 1917.